

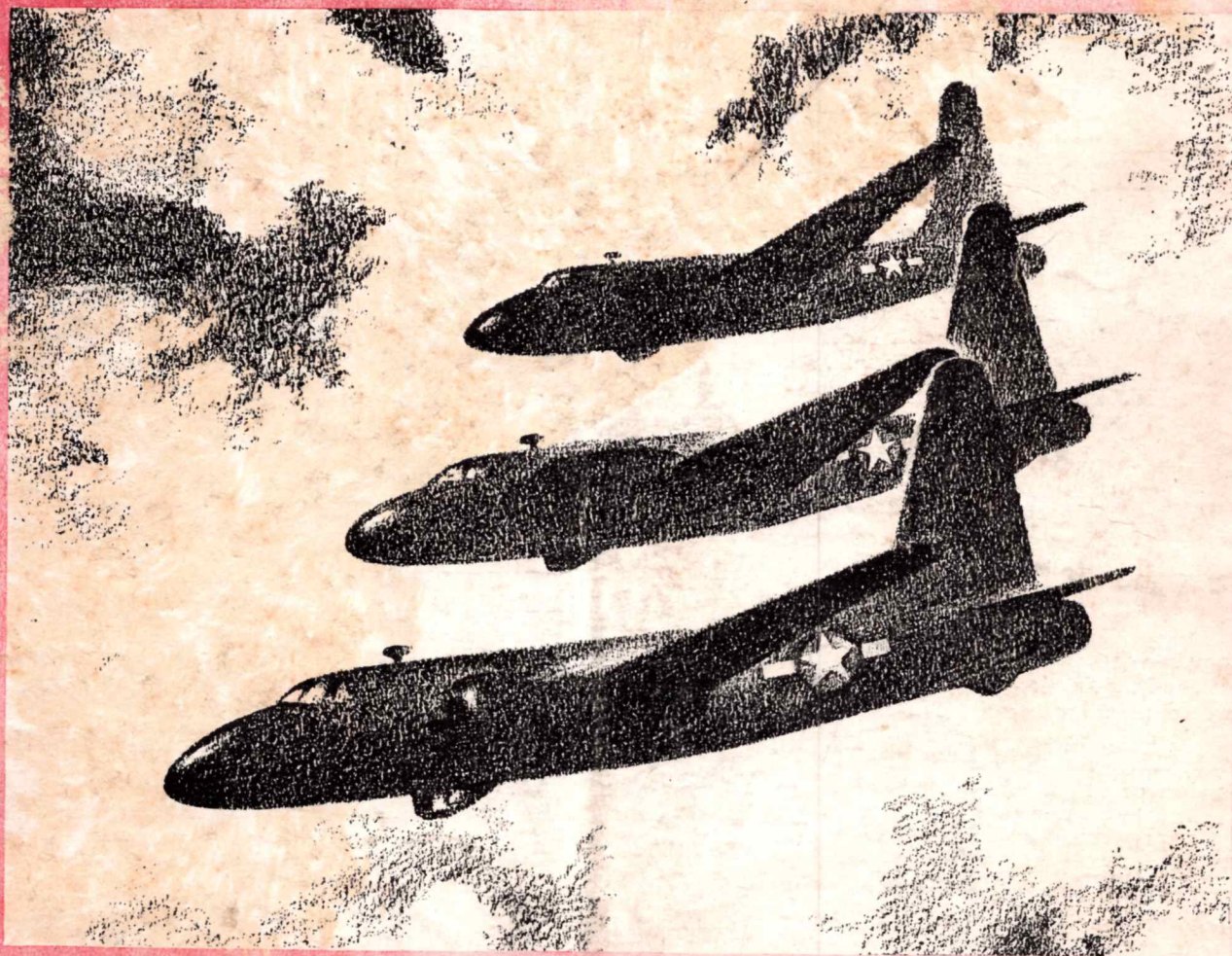
America's Premier Aeronautical Magazine

AERO DIGEST

INCLUDING
AVIATION ENGINEERING

SEPTEMBER, 1948

50 CENTS



Lockheed's P2V Neptune for the U. S. Navy—another new military aircraft equipped with Hamilton Standard reversible Hydromatic propellers.



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PYLONS

IN THOMPSON TROPHY RACE HISTORY...!

1929

... when DOUG DAVIS won

the first Thompson Trophy Race, his Travelair "Mystery Ship", with a Wright Whirlwind engine, averaged 194.90 m.p.h. around the closed course. It marked the first time that a civilian plane had defeated military ships in speed competition.



1932

... when the famous

JAMES H. DOOLITTLE set a new closed-course speed record that stood for four years. He flew a stubby red and white Gee Bee "Super-Sportsster" and averaged 252.68 m.p.h. for ten laps of the 10-mile Thompson Trophy Race course.



1936

... when MICHAEL DETROYAT

of France became the only foreign pilot to win a Thompson contest. His sharp-nosed Caudron-Renault racer averaged 264.26 m.p.h. and publicized to the world the advantages of streamlining and retractable landing gear for faster flying.



1938

... when the colorful

ROSCOE TURNER set the prewar record of 283.41 m.p.h. and gained added fame as the only pilot to win the Thompson Trophy twice. In 1939 he won the trophy a third time, stepped from his big Turner-Laird Special, and announced his retirement from air racing.



1946

... when the first postwar

Thompson contest was flown, and the first jet-powered planes competed in a Thompson Trophy Race. The "J" Division of the race was won by MAJOR GUS E. LUNDQUIST of the Army Air Force in a Lockheed P-80 "Shooting Star" at the brilliant average speed of 515.85 m.p.h.



1947

... when COOK CLELAND,

World War II ace, flying a stripped-down Navy "Corsair", averaged 396.13 m.p.h. to set a new record for piston engine planes. There were "over 3,000 horses under his cowl" and his speed exceeded by nearly 113 m.p.h. the prewar record of Roscoe Turner.



14th THOMPSON TROPHY RACE, LABOR DAY, CLEVELAND AIRPORT

SEPTEMBER 6TH—climaxing event of the National Air Races. Prize purse \$40,000.00. Established in 1929 to foster the development of higher air speeds combined with safety and practical maneuverability.

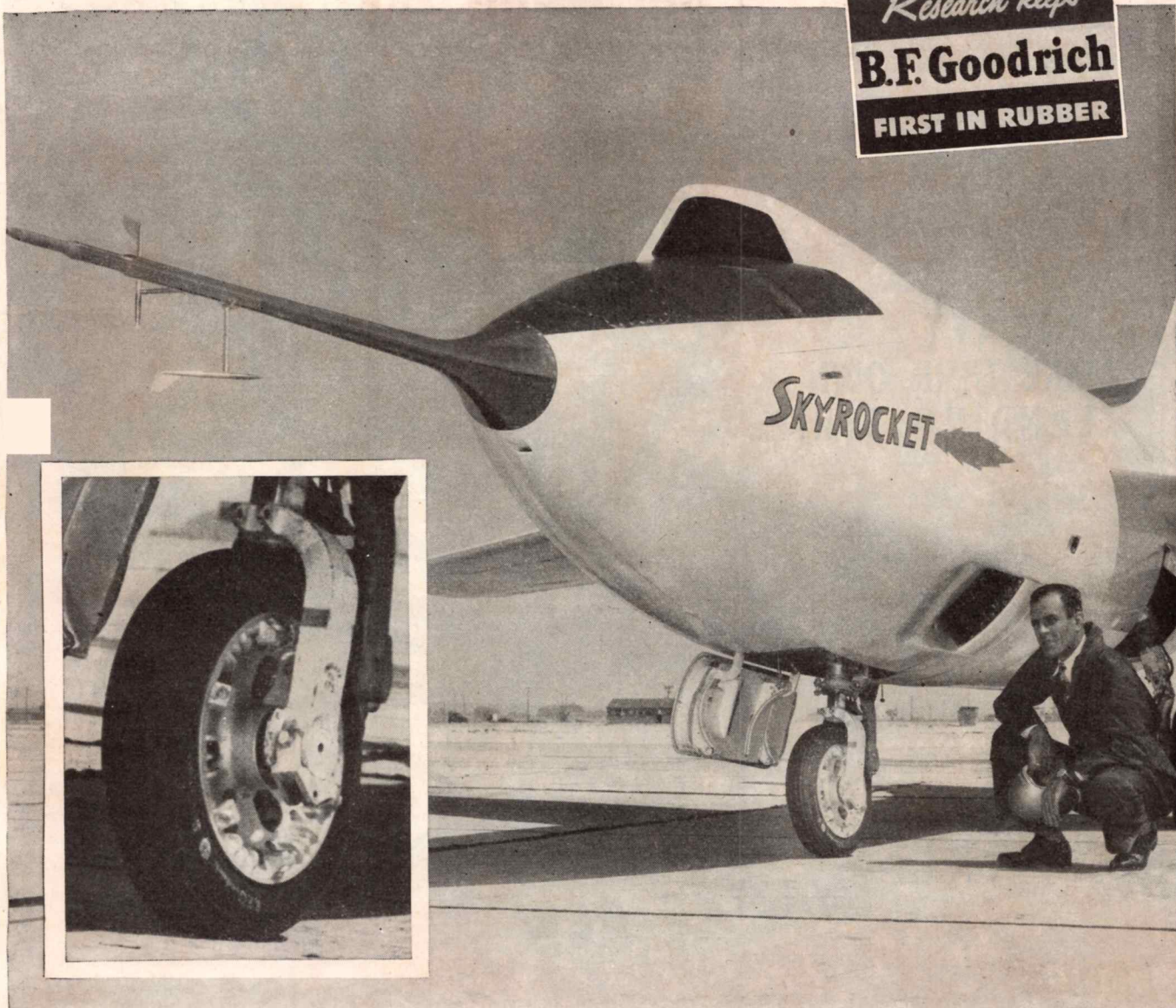


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Transonic plane's tiny tires hold 200 lbs. of air!

JOHNNY MARTIN, Skyrocket test pilot, shown above right after a landing, says those little tires are the most vital factor in a sonic plane's high-speed take-off. With engine or brake failure, he could let the plane roll to a stop. But if the tires blew out at 150 mph plus, the chances of controlling his little plane would be slim.

The tires on this Douglas-El Segundo Skyrocket, under "refused" take-off conditions, have to take the highest specific loading and highest speed yet required. Because they must be retracted into a very limited space,

they must be extremely small, yet strong enough to take the highest pressure ever used in a tire.

B. F. Goodrich engineers developed the tires that would do the job—for the main wheels, 10-ply nylons only 24 inches high and $5\frac{1}{2}$ inches thick! For the nosewheel, 8-ply nylons 20 inches high, less than $4\frac{1}{2}$ inches thick—all of them designed to carry 200 lbs. air pressure!

Those little tires on this Navy test plane are the strongest, safest tires ever built. They have back of them the long record of B. F. Goodrich engineering development on high

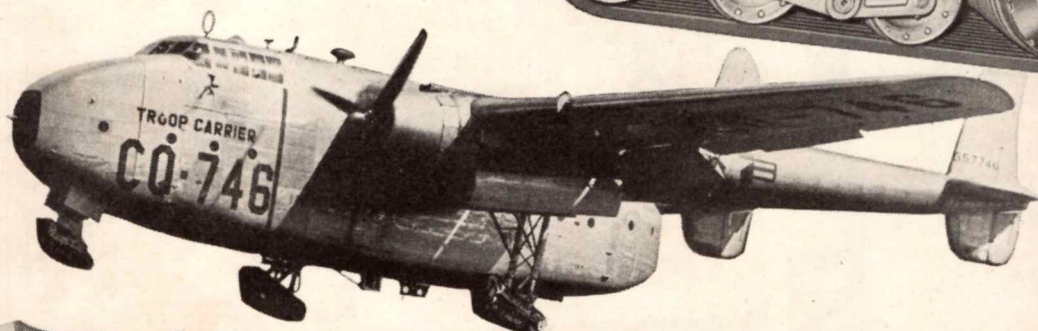
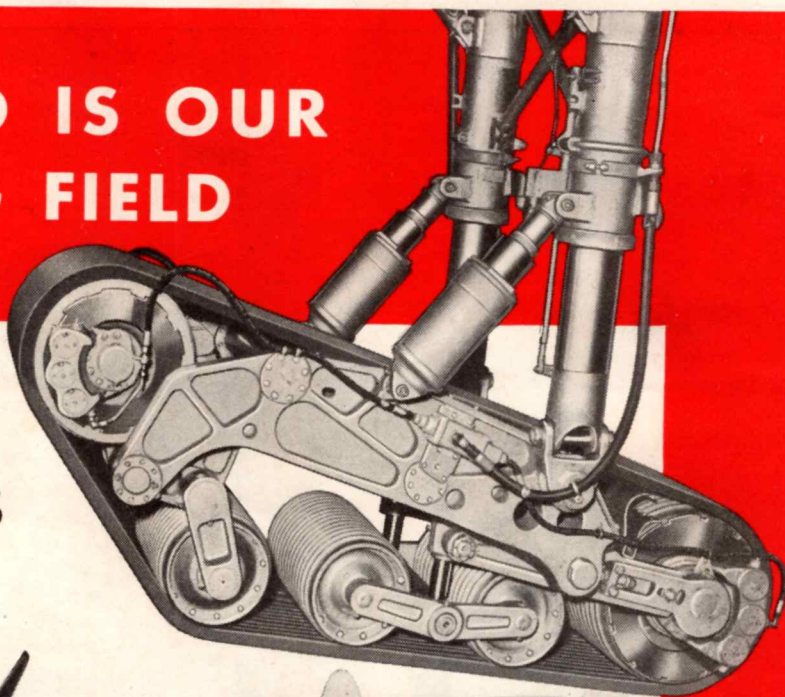
pressure airplane tires—from the first high pressure tires for Navy carrier landings about 20 years ago, to the extra high pressure tires to retract into the thin wings of the Skystreak, sister ship of the newer Skyrocket.

Constant research helps B. F. Goodrich to introduce sound, long-lasting solutions to the tough problems of a growing aviation industry. The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.

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LETTER TO ARMEN
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HOWARD MINGOS, Editor

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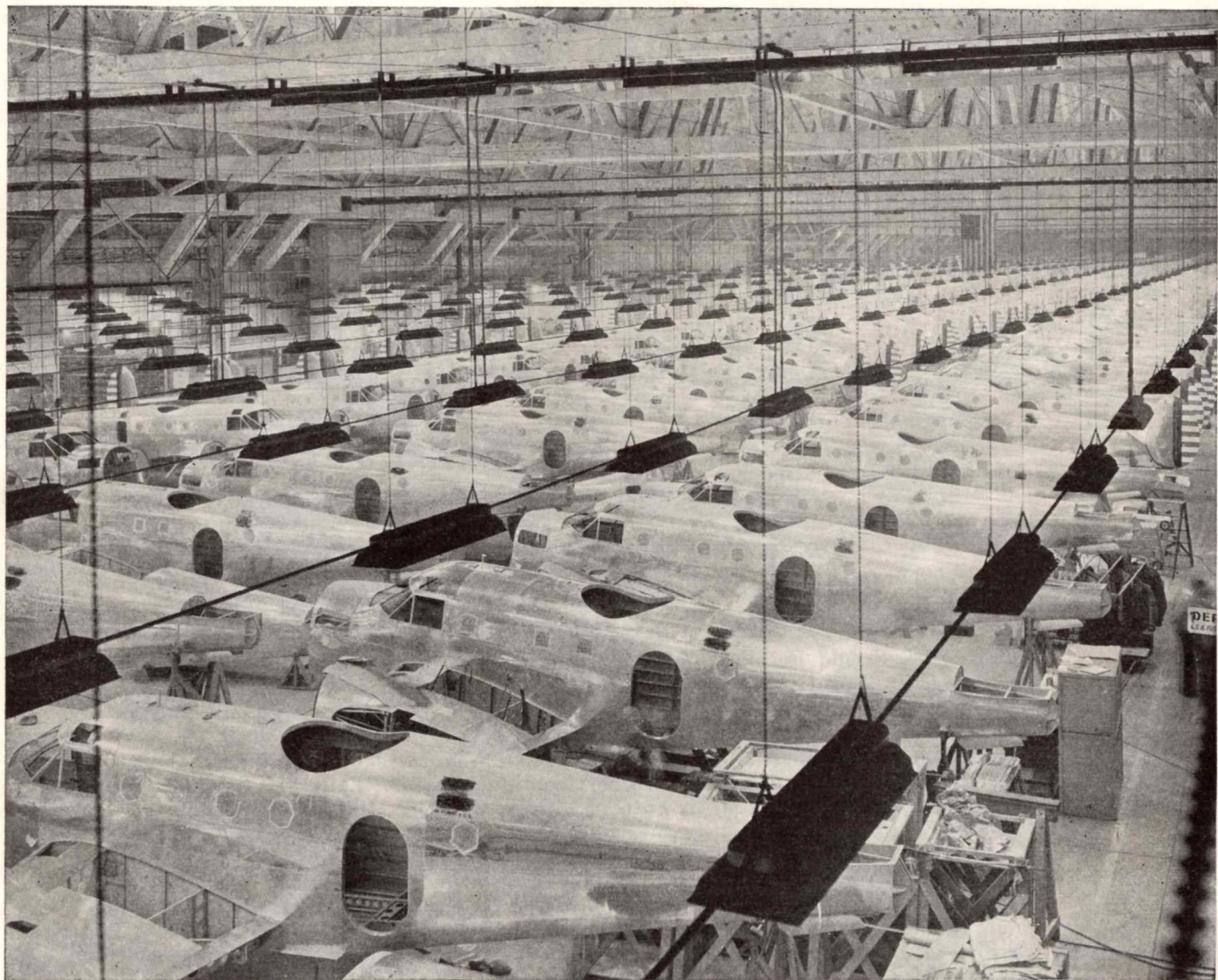
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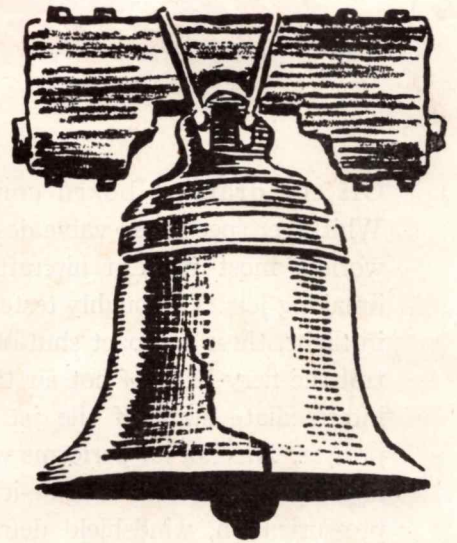


WICHITA, KANSAS, U. S. A.



EDITORIAL

A Friend Recalls



THE following extract is taken from a letter received at AERO DIGEST a few days ago: "Have been confined to my house, on doctor's orders, for the past three weeks and have been reading over my old file of AERO DIGESTS. You should reprint some of your wartime editorials. They read now as if you had a close contact with a clairvoyant or a soothsayer. Particularly those in your August 15, 1944 and February 15, 1945 issues, entitled, 'We Planned It That Way' and 'Henry Deserves Any Service.'"



Thanks, Jim, for the idea. So here are a few quotes from "We Planned It That Way":

"President Roosevelt in his rabble-rousing campaign speeches of 1936, after berating American industrialists as 'economic royalists,' 'princes of privilege,' and so on—the same industrialists who had made this the world's wealthiest country and who today are making possible the winning of this war—emphasized the time and effort he spent in planning for the future welfare of our nation. . . .

"How, then, of the way he has done things?"



"Well, back in 1932 we had a depression. . . . The morale of our people was low. . . . In the previous 100 years we had had several, some of them equally severe. . . .

"We had come out of them by using the formula that made the United States the greatest nation on earth—faith in our country, faith in ourselves, faith in our ability to overcome every obstacle by individual effort and systematic hard work.

"This formula had been proven right, so the New Dealers would have none of it. Oh, no! They must try something new—so Roosevelt called together all the fantailed economists, guinea-pig experimenters, witch doctors, soothsayers and medicine men in the land. . . .

"Then we were regimented. We were fingerprinted, earmarked, classified, numbered, told where we could work and for what wages we could work, told what we could plant and where we could plant it, what we could harvest, and where we could sell it, what we could buy and where we could buy it—and the prices we had to pay for it. We were forced to slaughter over six million pigs and nearly a million cattle, and destroy hundreds of thousands of acres of farm products.

"So progressed Roosevelt's 'planning' . . .



"Our 'we-planned-it-that-way' ruler, to date, seems to have been consistent in upsetting something that made America what it was before his advent. We suspect that all this 'planning' is for a sinister purpose—for the purpose of creating confusion, class hatred, discord and conflict . . .

"In 1934 Mussolini also had a 'plan' and a depression. So said Il Duce, 'I will keep the boys busy, too busy to think of the depression' and along came the Ethiopian war. Here we had ten million out of work during the 1932-to-1940 Roosevelt depression! Today we have ten million fighting in our Armed Forces.

"It couldn't have been planned that way!

"At the Democratic State Convention, held in Syracuse, N. Y., in 1946, President Roosevelt said: 'I have not sought, I do not seek, I repudiate the support of any advocate of Communism or of any other alien 'ism' which would—by fair means or foul—change our American Democracy. That is my position. It always will be my position.'

"In contrast, the leader of the Communists, one Earl Browder, after a jury trial on January 22nd, was convicted of a Federal crime and sentenced to four years in jail. The Supreme Court sustained his conviction. . . . On May 16, 1942, President Roosevelt pardoned Browder.

In the year of our Lord 1944, the Communists held a national convention in New York to nominate a candidate for the presidency. Do they nominate Browder? No! Roosevelt is good enough for them!

"Perhaps this also was 'planned that way.'"
End quote.



Now a few paragraphs from "Henry Deserves Any Service" in the February 15, 1945 issue:

"Send for Browder! Page Hillman! Call all followers of the Communist line! The crack-pots dance with glee! Wallace is to be Secretary of Commerce! The country's industrial economy is to be a planned economy, and the nation laid helpless under totalitarian feet! . . .

"Left-wingers and nitwit ideologists lick their chops. The apostle
(Continued on page 115)

Whittaker SLIDING GATE VALVES

A NEW VALVE

Off the drafting board comes another Whittaker specialized valve designed for the world's most modern aircraft—the record-breaking jets. Thoroughly tested and proven in flight, these compact shut-off valves control the fiery blast of hot air taken from an intermediate state of the jet engine compressor. This hot air performs vital functions in jet aircraft such as wing de-icing, fuel tank pressurization, windshield defrosting, cabin air temperature and pressure regulation, and ammunition temperature control. This new Whittaker valve, which may be operated electrically or manually, is being installed on virtually all jet-propelled aircraft now under construction by leading manufacturers.

In typical installations, the large 3½" Whittaker Hot Air Valve controls the main compressed air take-off from the jet engine. Then to control the hot air further, smaller Whittaker valves ranging from ½" to 2" in diameter allow the pilot to defrost the windshield, de-ice the wings, etc.

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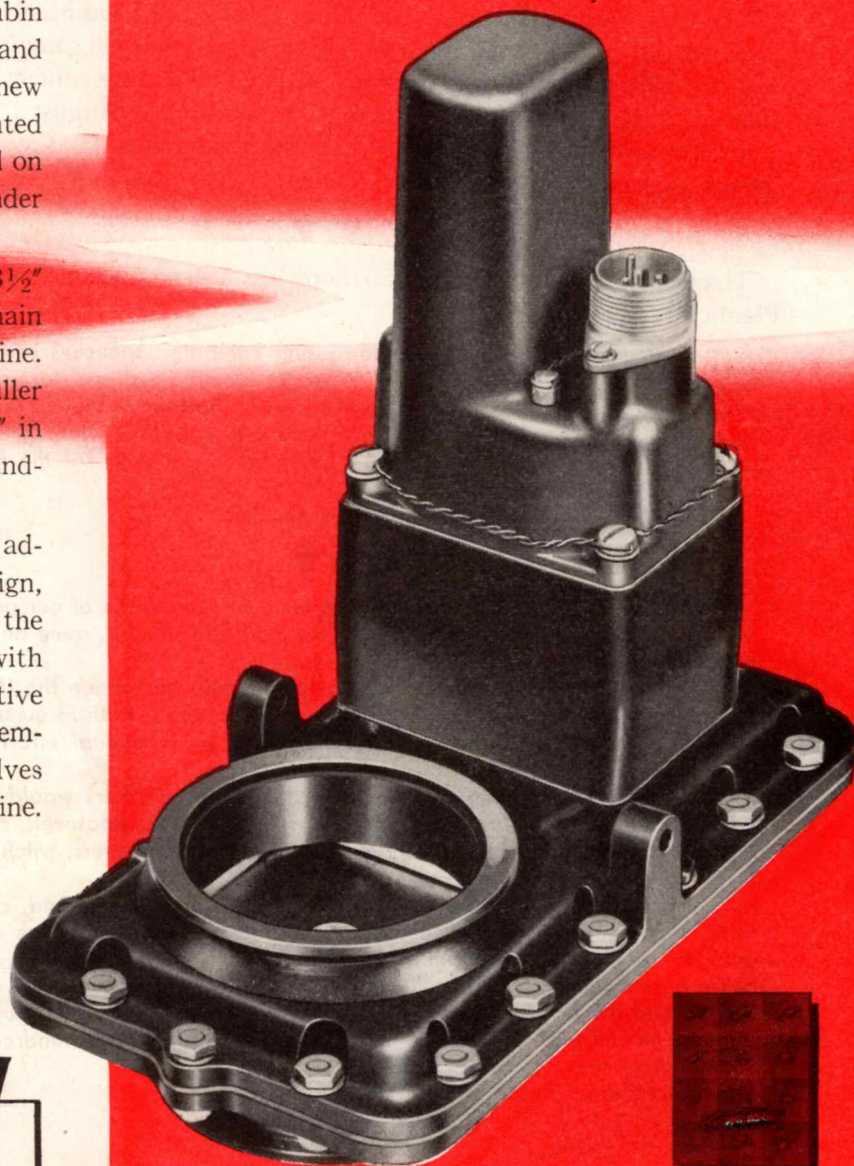
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Pressures to 125 psi

Sizes, port dia.

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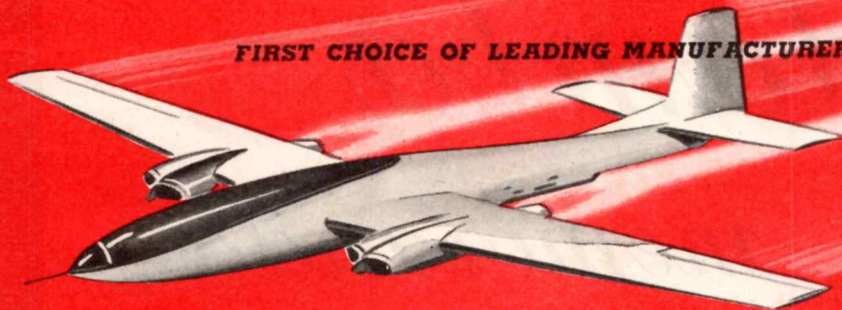


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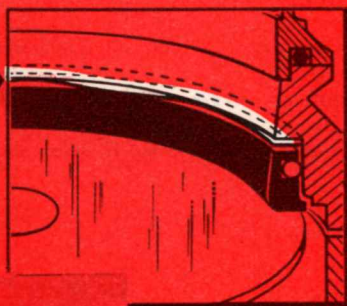
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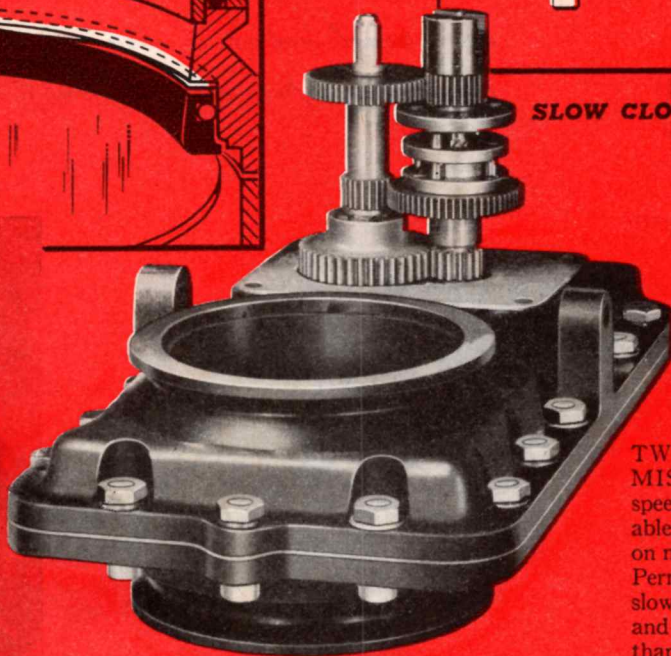
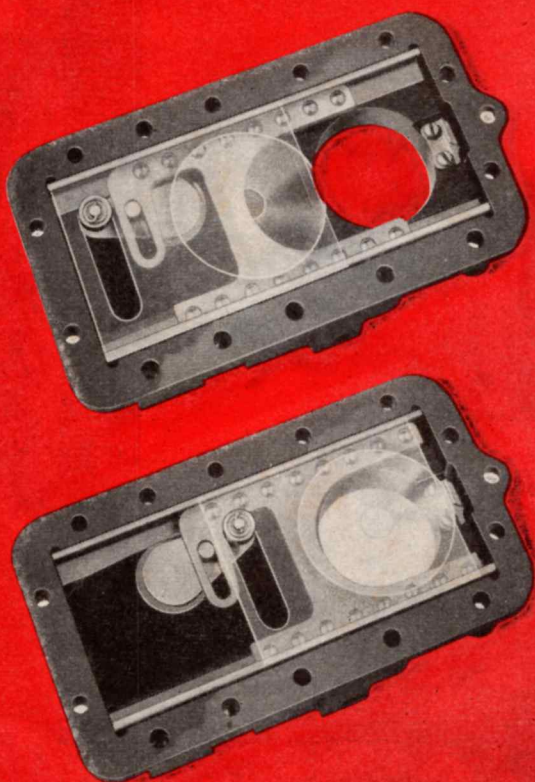
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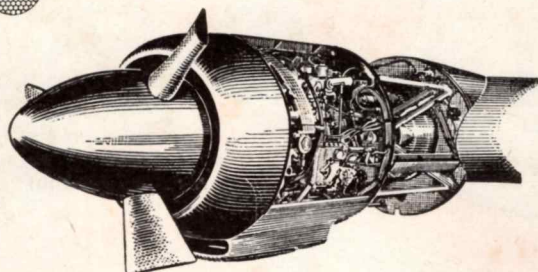
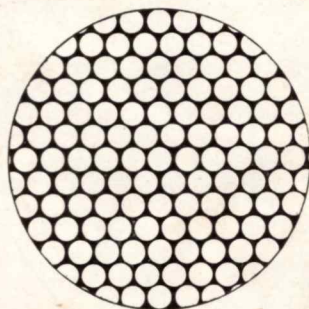
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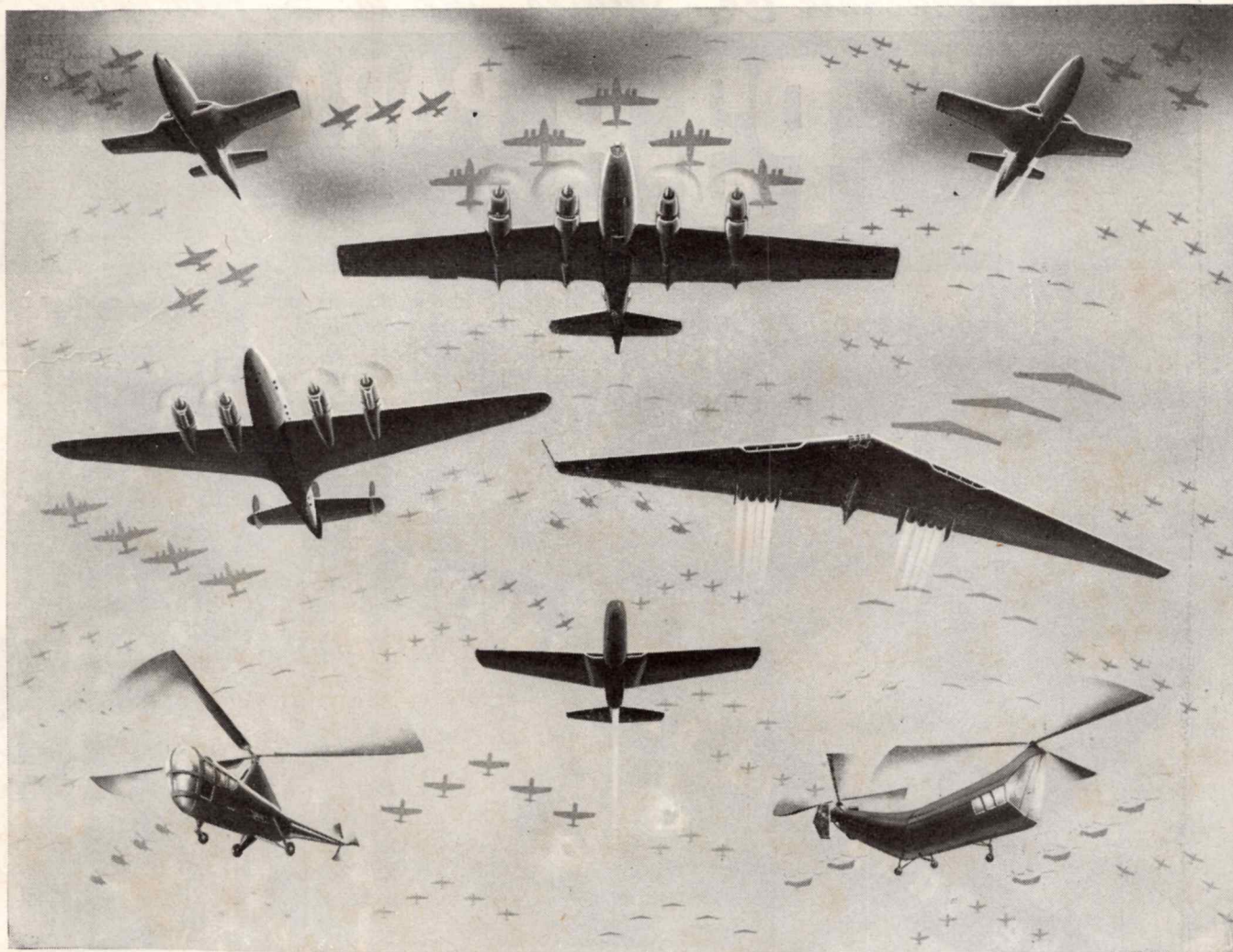
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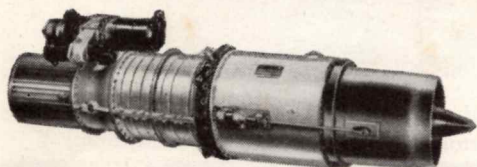
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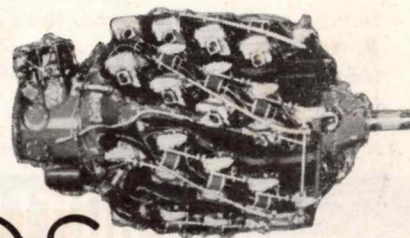
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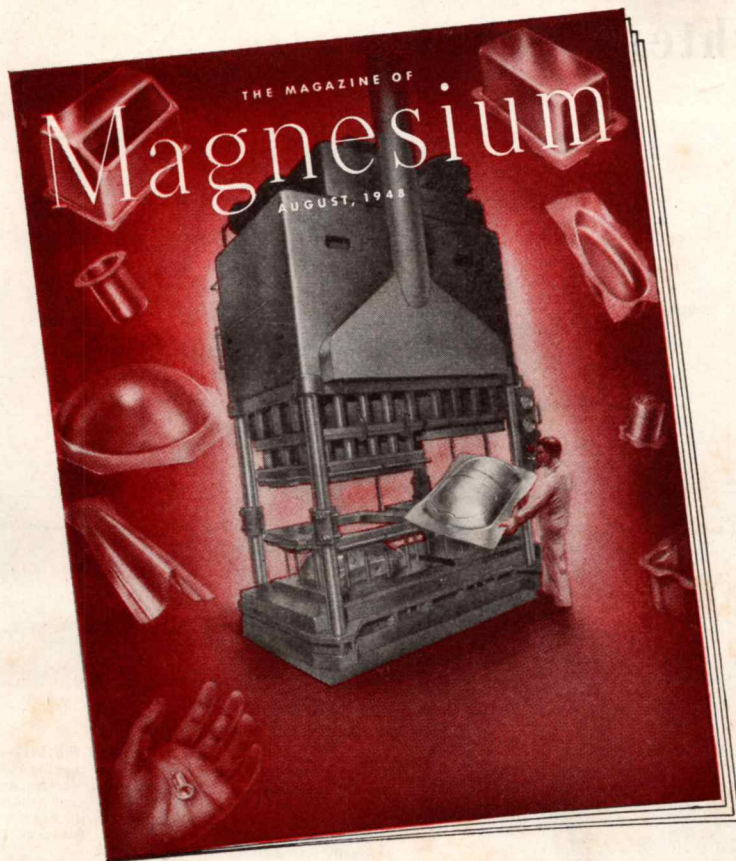
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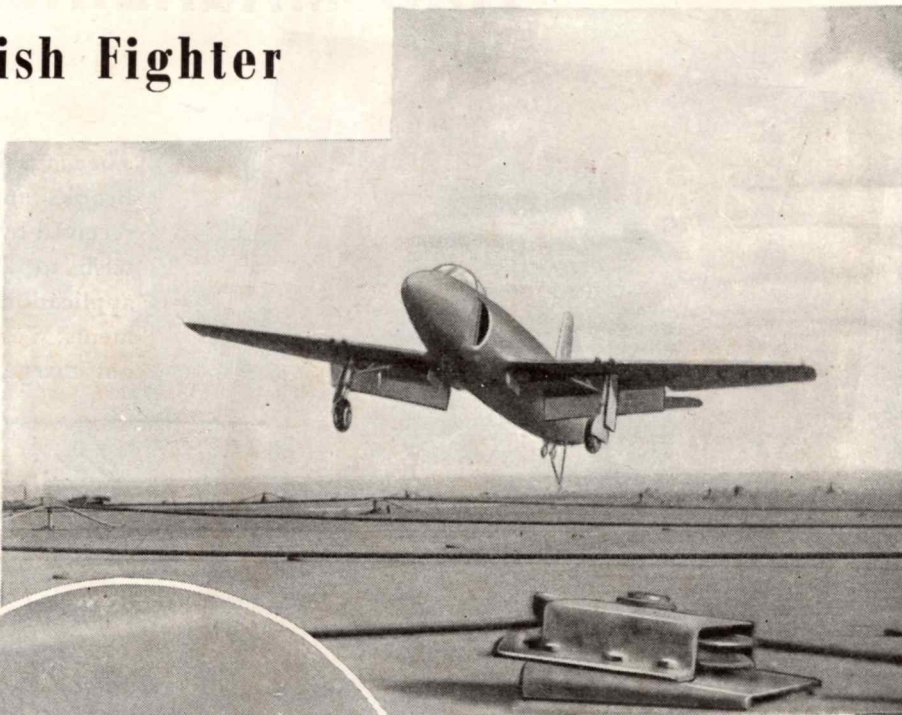
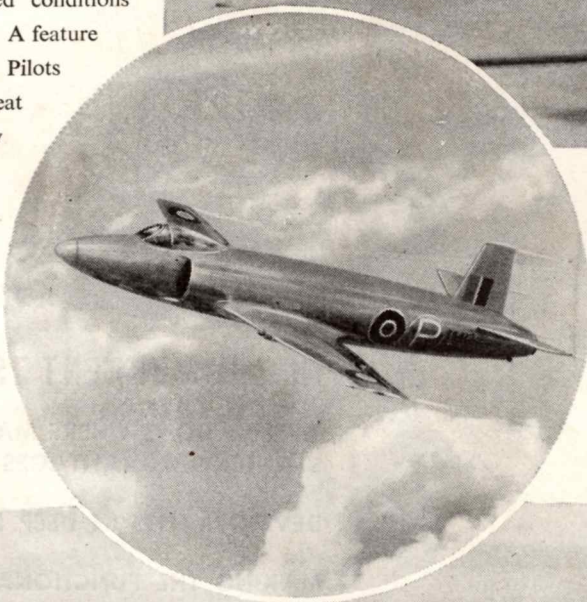
THE SUPERMARINE 'ATTACKER'

Outstanding British Fighter

Recent performances of the Vickers Supermarine 'Attacker' have confirmed it to be the World's most outstanding jet fighter. The speed and general manoeuvrability of the 'Attacker' were amply demonstrated on February 27th of this year when, carrying full military equipment, it covered the International 100 Km Closed Circuit at an average speed of 564.8 m.p.h. Previously, the 'Attacker' had carried out a series of successful deck landing trials on the Aircraft Carrier H.M.S. 'Illustrious'. These trials confirmed its adequate control characteristics under the low speed conditions necessary for deck approach. A feature of particular interest to Pilots called upon to manoeuvre at great speeds is the excellent visibility from the cockpit.

IN THE AIR

Superb manoeuvrability, rapid acceleration and rate of climb are features which make the Vickers-Armstrongs 'Attacker' unparalleled as a service fighter. With four 20 mm. Hispano cannons as standard armament the 'Attacker' lives up to her name.



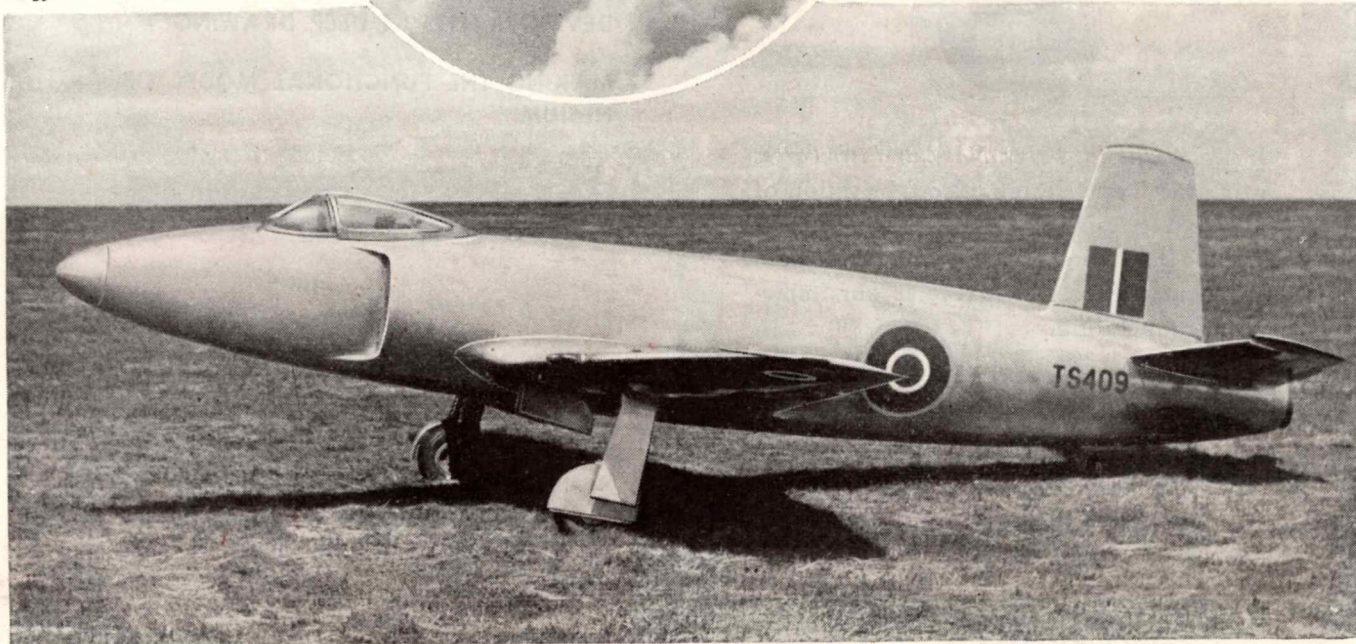
'LANDING ON'

The proved flying characteristics of the Vickers Supermarine 'Attacker' jet fighter enable this famous 'plane to take-off from a carrier and 'land-on' in perfect safety. With good control at a speed near stalling-point and with excellent visibility from the cockpit, the 'Attacker' is ideally suited to naval requirements.

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On 27th February an 'Attacker' jet fighter set up a new record for the closed circuit at 564.8 m.p.h. —fully loaded. This was one more convincing argument to support the Vickers-Armstrongs claims for this outstanding jet fighter.

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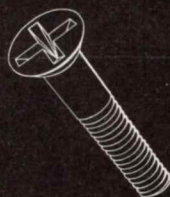
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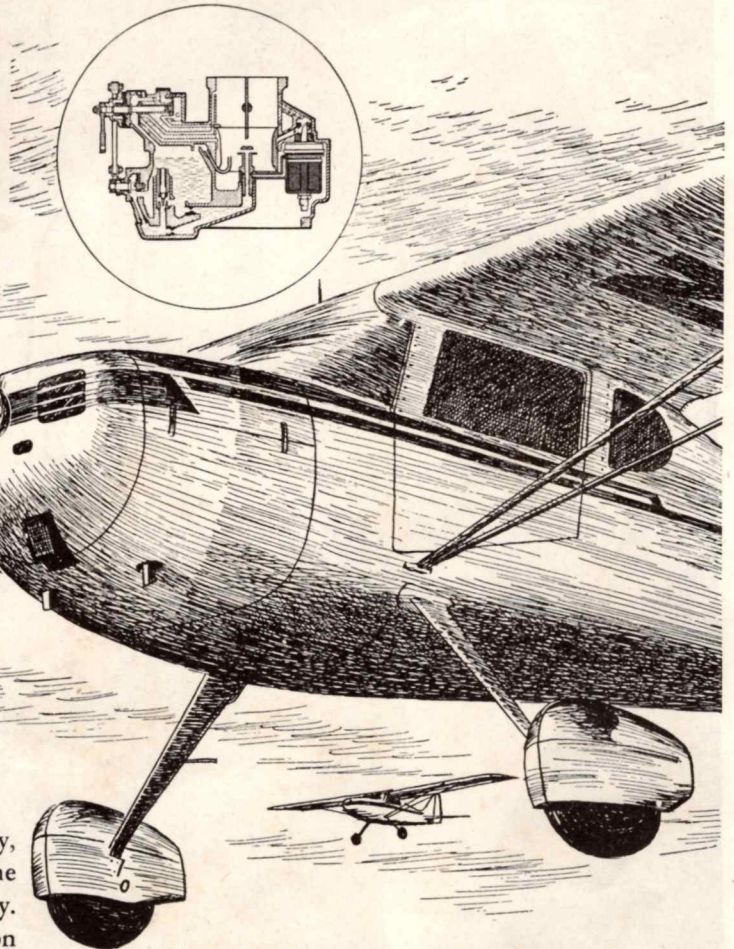
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Manufacturers of Recessed and Slotted Wood Screws, Sheet Metal Screws, Machine Screws, Stove Bolts. Also Cap Screws, Set Screws, Machine Screw Nuts, Wing Nuts, Rivets and Burrs, Rods, Screw Drivers and Bits, Specialties.

PLANE FAX



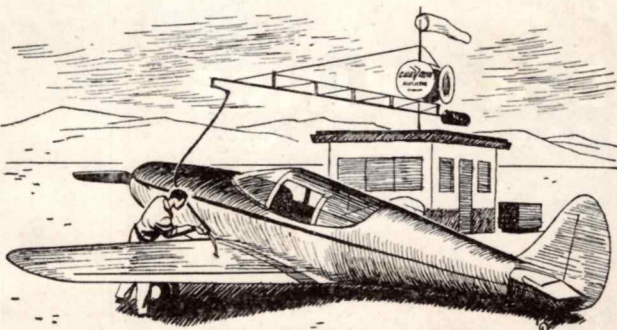
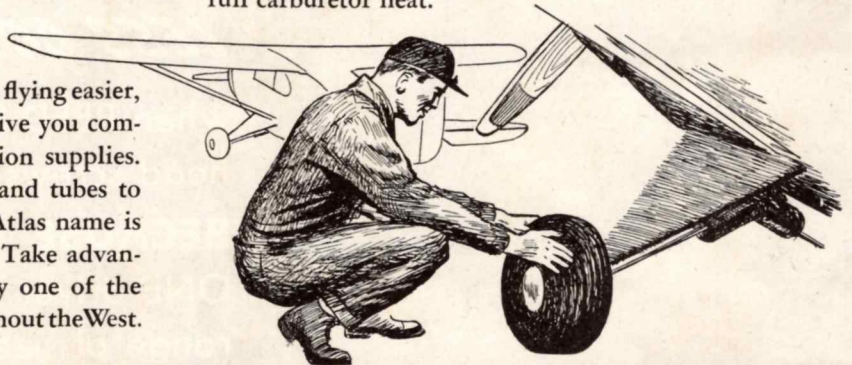
One way to avoid clogged carburetors

If gasoline containing excessive gum is used continuously, intake valves will stick or the carburetor may become clogged, resulting in decreased performance and economy. Thanks to exhaustive research, the gum content of Chevron Aviation Gasoline is rigidly controlled—another reason leading aircraft manufacturers and airlines throughout the West use Chevron Aviation Gasoline exclusively.

Save time with Standard's "One-Stop Service"

As part of a carefully developed plan to make flying easier, Standard Airport Dealers are equipped to give you complete *one-stop service* on top-quality aviation supplies. With everything from Atlas Aircraft tires and tubes to flashlights and plastic cleaner, the famous Atlas name is your assurance of dependability and safety. Take advantage of this more convenient service at any one of the hundreds of Standard Airport Dealers throughout the West.

Carburetor icing may be indicated when loss in rpm, sticking throttle or erratic engine operation are noted when outside air temperature is 70° or less, even though rain, fog or other visible precipitation may not be evident. At the first indication of erratic engine operation, apply full carburetor heat.



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Maintenance records for all types of planes prove that Packard high-altitude aircraft ignition cable gives more HPR—more *Hours Per Replacement. For this cable is different in design, in materials, in construction . . . engineered for greater mechanical and dielectric strength. Its improved resistance to heat, cold, oil, corona, moisture and abrasion safeguard performance under all conditions. Specify Packard high-altitude aircraft ignition cable for more *Hours Per Replacement.

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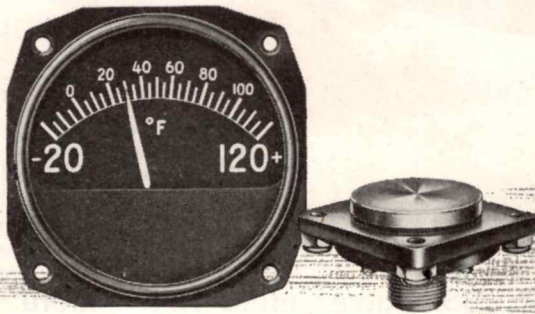


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For the wings of tomorrow

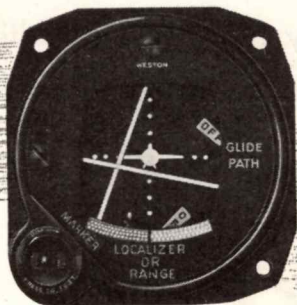
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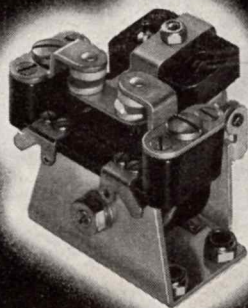
As new instrument needs arise in your planning, review the instruments now available at WESTON—where development has kept abreast of the latest requirements. Or, for special needs, complete engineering cooperation is freely offered. WESTON Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey.

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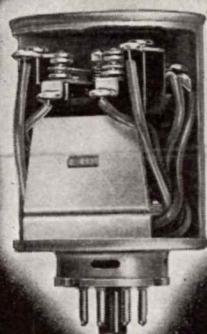
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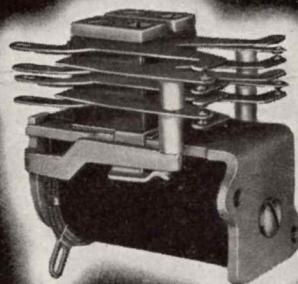
RELAYS OF ADAPTABILITY



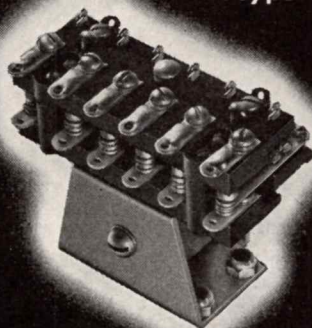
Type CN



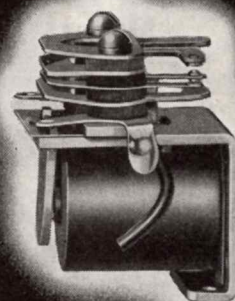
Type BOHO



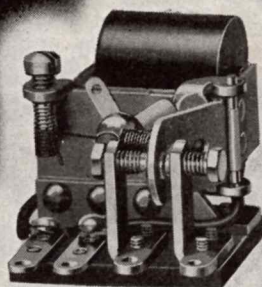
Type SK



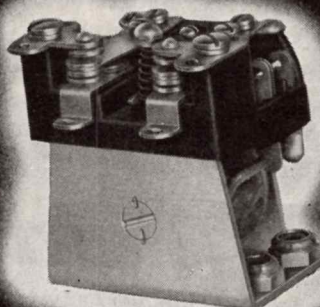
Type BN



Type F



Type BG



Type BO

Thousands of specifications are filled by the complete line of Allied Relays—seven of which are grouped around the Allied emblem of engineering leadership.

Allied Control engineers pioneered the design of relays from signal circuits to 75 ampere contacts, coils from 12 milliwatts to $3\frac{1}{2}$ watts to give the smallest mounting area and accessible wiring facilities.

*Type "BOHO" is D.P.D.T. relay sealed with standard octal plug. Contact rating of 5 to 10 amperes and coil capacity of 115 v. D.C. at 2.5 watts and 220 volts; 25 and 60 cycles at 4.5 volt-amperes.

*Type "CN" is S.P.S.T. double break relay with 50 ampere contacts and coil capacity of 115 v. D.C. at 3.5 watts and 220 volts; 60 cycles at 10.5 volt-amperes.

*Type "BN" is 6 P.D.T. relay with 15 ampere contacts and coil capacity of 115 v. D.C. at 3.5 watts (not available

in A.C.).

*Type "BG" is S.P.D.T. relay with 2 ampere contacts and coil capacity of 25 v. D.C. at 50 milliwatts (not available in A.C.).

*Type "BO" is D.P.D.T. relay with 15 ampere contacts and coil capacity of 115 v. D.C. at 2.5 watts and 220 volts; 25 and 60 cycles at 4.5 volt-amperes.

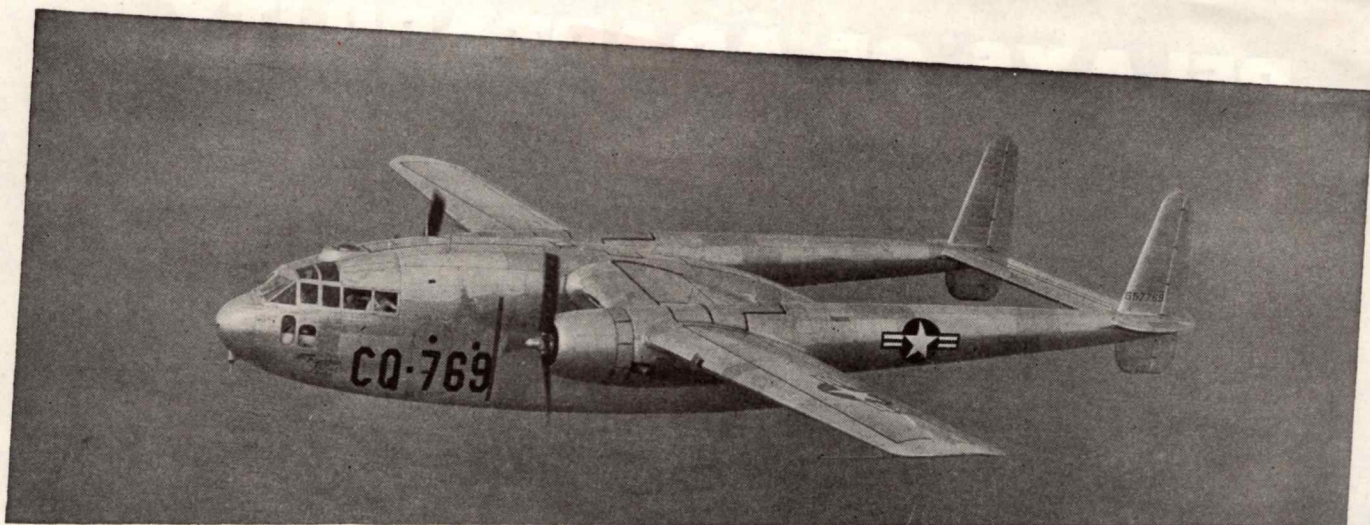
*Type "F" is S.P.D.T. with 2 ampere contacts and coil capacity of 85 v. D. C. at 1.5 watts (not available in A.C.).

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Now! An Even Bigger, Better Flying Boxcar —The Fairchild Packet C-119

Something new in the air.

Out of the tried and proved first plane ever designed specifically for cargo-carrying has come this latest creation of Fairchild engineers—a super Packet.

Like the original C-82 Packet, the C-119 is a product of close cooperation between Fairchild and the Air Force.

But, with increased payload, speed and climb, the new Packet can transport more men,

more equipment and more supplies than its worthy predecessor. As an ambulance plane it is equipped to carry 36 litter patients and attendants.

This new Flying Boxcar incorporates improvements and modifications proved in thousands of hours of actual service. All in all, it is flying evidence of an air-transportable Army . . . and of Fairchild engineering and research skill.



Fairchild Aircraft

Division of Fairchild Engine and Airplane Corporation, Hagerstown, Maryland



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In the present great defense program, Cleco Pneumatic Tools are demonstrating day in and day out their efficiency for that dynamic military service—the United States Air Force.



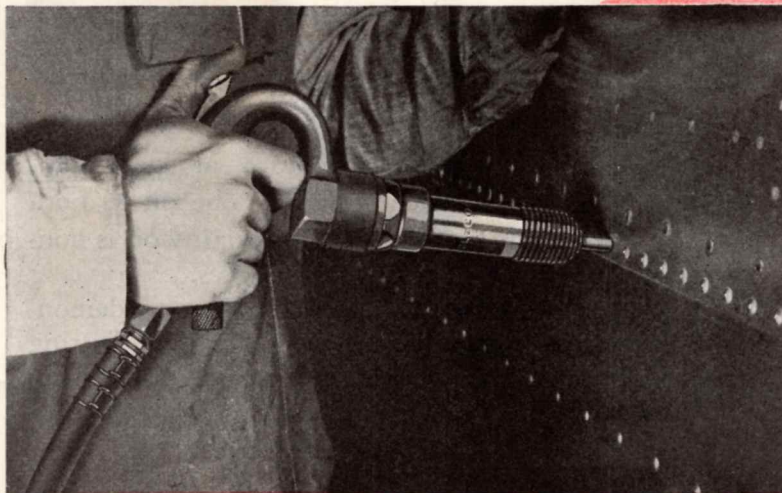
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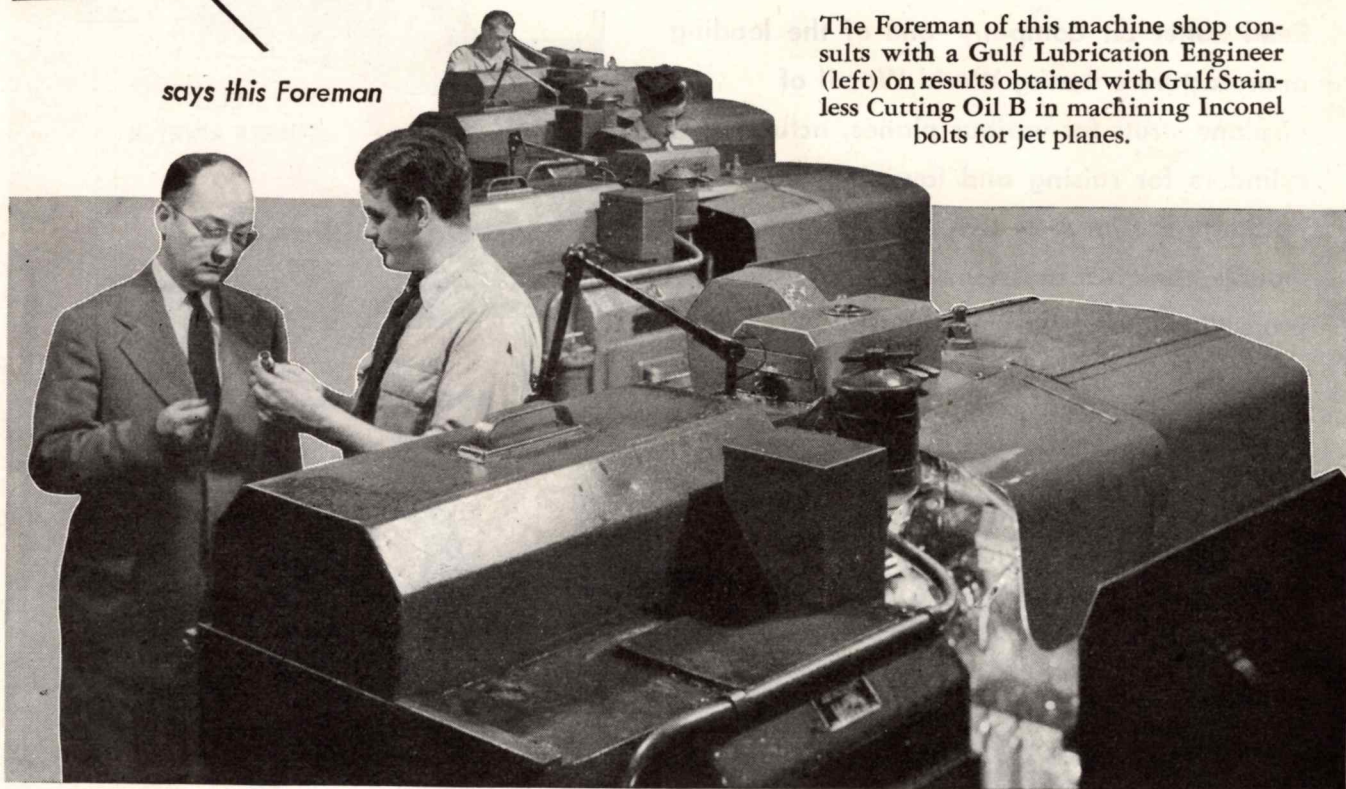
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*"With **Gulf Stainless Cutting Oil B**
we increased production and tool life"*

says this Foreman

The Foreman of this machine shop consults with a Gulf Lubrication Engineer (left) on results obtained with Gulf Stainless Cutting Oil B in machining Inconel bolts for jet planes.



"Use of this quality dual-purpose oil means the difference between profit and a loss for us in machining Inconel bolts."

"Gulf Stainless Cutting Oil B helped us solve a tough problem in machining jet aircraft bolts of Inconel X," says this Foreman. "Before we used this quality cutting oil, we could produce only 15 to 18 pieces before regrinding the tools."

"Now with Gulf Stainless Cutting Oil B, we often run as many as 150 pieces without touching the tools. Use of this cutting oil means the difference between making money on the job and a heavy loss."

A typical report from the scores of plants which have improved production and tool life through the use of Gulf Stainless Cutting Oil B. In addition to its outstanding performance as a cutting oil, Gulf Stainless Cutting Oil B also provides excellent lubrication for the working parts of

machine tools. Thus it serves as an ideal dual-purpose oil in machines using one oil as both lubricant and cutting oil. This quality oil is non-corrosive to finished metal surfaces.

Ask a Gulf Lubrication Engineer to demonstrate the advantages of Gulf Stainless Cutting Oil B and other quality cutting oils in the complete Gulf line in your shop. Write, wire, or phone your nearest Gulf office today.



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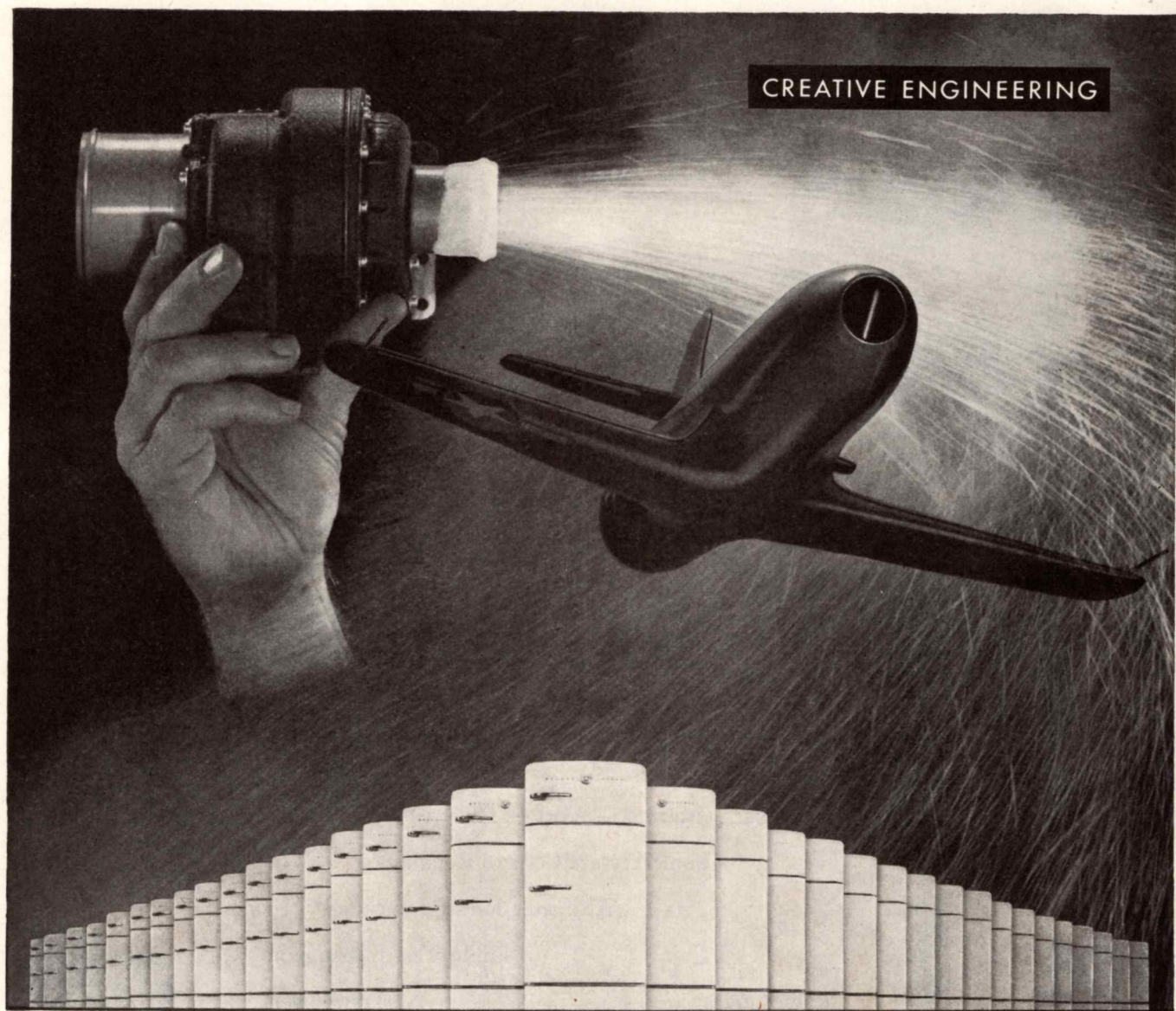
KOLLSMAN INSTRUMENT DIVISION



ELMHURST, NEW YORK

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CREATIVE ENGINEERING



ICY "BLOWTORCH" to cool the screaming jets!

When the Douglas Skystreak blazed over desert sands to set a world speed mark of 651 m.p.h., a midget AiResearch turbine smaller than a plumber's blowtorch tossed snowflakes into the cockpit!

Bleed air from the jet engine, source of air for the turbine, was a searing 500°. Yet the AiResearch turbine—with the cooling capacity of 35 household refrigerators—discharged 40° air into the cabin to keep the temperature at a livable 90°.

Heart of this magic turbine is a rotor which spins up to a cyclonic 100,000 revolutions per minute. Crash pit tests in AiResearch laboratories spin these rotors until they explode at plus 140,000 r.p.m.—one of the fastest speeds ever attained by a man-made wheel. Thus perfect safety and performance are assured under the most exacting conditions.

A decade ago AiResearch pioneered the field of turbine refrigeration... designed and built the first experimental models. Today it is equipping a major share of all jet-propelled airplanes under construction or flying in the United States.

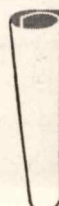
• The engineering "know-how"... the research and laboratory facilities... and the manufacturing skills of AiResearch are now available to you, whatever your field may be.

AiResearch engineers invite your toughest problems, involving high-speed wheels and rotors. Specialized experience is also available in creating compact turbines and compressors; actuators with high-speed rotors; air, gas and fluid heat exchangers; air pressure, temperature and other automatic controls.



Write: AiResearch Manufacturing Company, Los Angeles 45, California.

Air Force Day—Sept. 18



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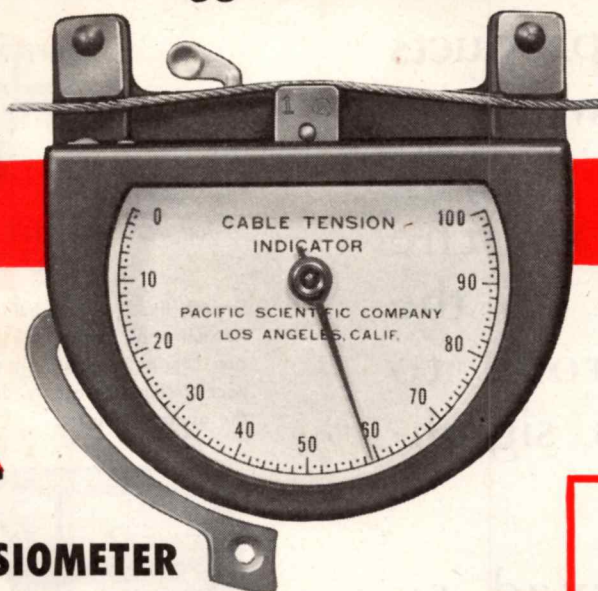
NEW

SECONDARY CONTROL CABLE

Tensiometer

FOR LOW RANGE

...more accurate low tension readings on control cables rigged as low as 15 to 20 lbs.



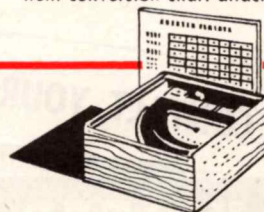
THE **NEW** STURGESS Tensiometer

Designed to give absolute accuracy in testing low tension control cables, even when rigged as low as 15 to 20 pounds. Compact construction permits one-hand operation through small openings. A built-in indicator lock permits accurate reading after tensiometer has been removed from areas where the dial cannot be seen.

The Sturgess Tensiometer dial indicator requires no zero resetting. This instrument, used in conjunction with the standard high-tension tensiometer gives complete, accurate, cable tension from the lowest to the highest cable tension required.

EXCLUSIVE STURGESS FEATURES

- One-hand operation permits easy access to difficult rigging.
- Absolute accuracy on low tension cables.
- Built-in indicator lock permits dial readings after testing tension in blind spots.
- Requires no zero resetting.
- Packed in sturdy case with permanent conversion chart attached to lid.



When ordering, specify control cable size and rig tension required.

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As we served so shall we continue to serve!

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The UNITED STATES ELECTRICAL TOOL Co.
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Faster... more dependable!



ground power supply equipment

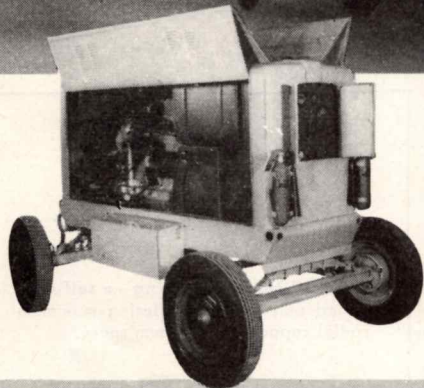
Built to conform with specifications of aircraft engineers, MGC is the choice of today's leading airlines.

Ground crews can conveniently make pre-flight checks of radio and electronic equipment, operate heating and ventilating systems, start engines for the take-off, etc. Models to fit the requirements of any aircraft or airport are available. Write for complete engineering data and specifications.

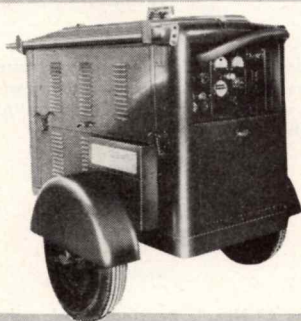
Motor Generator Corporation, Box AD-98, Troy, Ohio

HOBART BROTHERS AFFILIATE

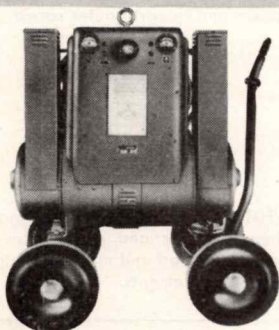
"One of the world's largest builders of electric generating equipment"



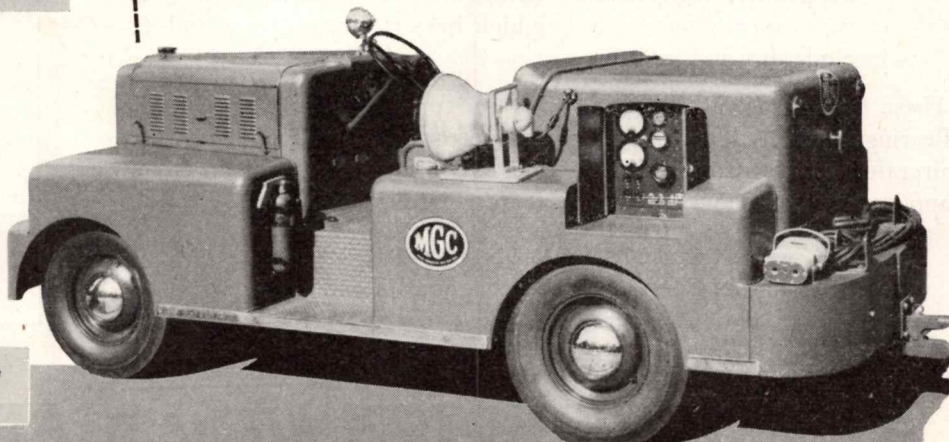
For DC-6 and other new design aircraft with heavier ground electrical load requirements.



This unit supplies power to DC-3, DC-4, CV-240 and similar aircraft.



For shop use, hangar or apron service where electric power is available.



The MGC POWERMOBILE services DC-6 and larger aircraft. Two of these units in parallel will take full electrical load of Boeing 377.

Making aircraft lighter, trimmer, safer and more serviceable with Torrington Needle Bearings



ONE OF THE IMPORTANT ADVANCES in aeronautical engineering has been the application of Needle Bearings to provide anti-friction operation in aircraft. These efficient, high-capacity anti-friction units have found wide and diversified application in aircraft mechanisms where lightweight, compact construction must be secured with the highest possible bearing capacity. Torrington Needle Bearings are:

Light for flight—precision, small diameter rollers retained in a thin hardened and drawn shell mean lightweight construction, and often permit weight savings in design of related elements.

Compact for trim design—unusual compactness is achieved to eliminate bulk in anti-friction assemblies.

Safe for heavy loads—for all their compactness, Needle Bearings provide a much higher radial capacity than any other anti-friction bearing of comparable size, owing to the full complement of small diameter rollers.

Smooth-running for low wear—the low coefficient of starting and running friction reduces wear to a minimum, assuring long service life in installations where they operate for years without play or vibration.

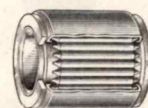
Efficiently lubricated—turned-in lips of retaining shells of all types form effective seals which help retain lubricant and exclude dirt and moisture.

These features are available in the many types of Torrington Needle Bearings illustrated, each developed to meet specific requirements of the aircraft industry. Consult Torrington's engineers in their selection and application. Call or write the nearest Torrington office.

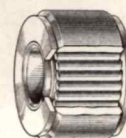
THE TORRINGTON COMPANY
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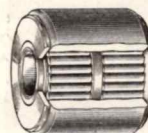
Type DC Needle Bearing—a self-contained unit assembly offering maximum radial capacity in minimum space.



Series AR Needle Bearings—unit assemblies with inner race and retaining washers, designed for use with standard "AN" bolts.



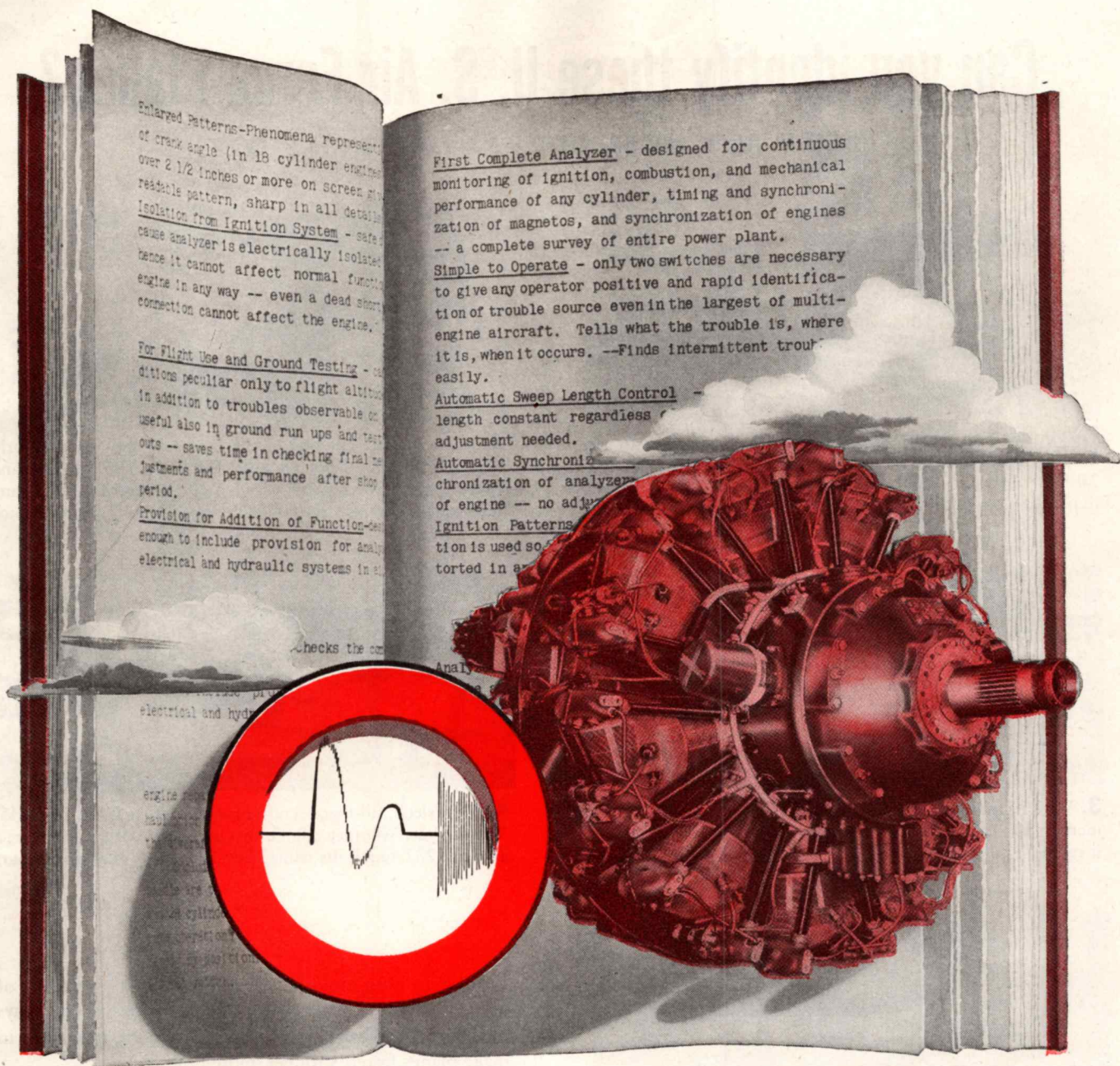
Type AT Needle Bearings—designed for use in aircraft control systems, consisting of inner races, full complement of ball-end rollers and integral outer races.



Type FDT Needle Bearings—designed with heavier inner and outer races to meet maximum load and minimum weight and space requirements.

TORRINGTON NEEDLE BEARINGS

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TWO SECONDS!

Flying Time

MORE HOURS!

READING TIME... TWO SECONDS. The Sperry Engine Analyzer visualizes aircraft engine performance as fast as that.

In the Analyzer scope, the flight engineer can examine graph-like patterns that detect, locate and identify *every* engine, magneto or ignition irregularity that occurs during flight or pre-flight check-up.

From his accurate report—covering both the nature of the difficulty and its location—the ground crew can make small mechanical corrections in minutes.

FLYING TIME... MORE HOURS. The Sperry Engine Analyzer is therefore a three-way profitable investment for the airline operator.

It eliminates the *little* engine troubles before they grow *big* and cause expensive repairs, the lost profit of grounded planes and interrupted schedules.

It improves passenger relations by assuring *on-schedule* arrivals and departures. It lowers maintenance costs, keeps planes out of the hangar and in the air.



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Can you identify these U. S. Air Force Planes?

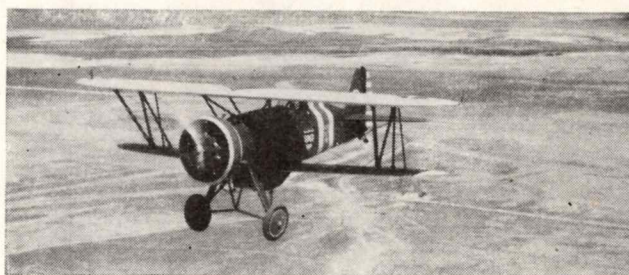
(EACH WAS A MILESTONE IN AVIATION HISTORY)



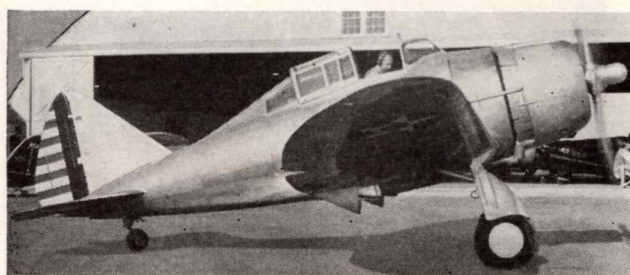
1. This was the world's first military aircraft, accepted by the U.S. Army August 2, 1909. A twin prop pusher powered by a 30 h. p. engine, it had a 36'-5" wing span and flew all of 42 m.p.h. If you said "Wright Bros., B-Pusher," you're right.



2. French made, but one of the best AEF fighters of World War I, this highly maneuverable ship had a 180 h.p. Hispano engine, did a spectacular 127 m.p.h. and carried a 37 mm. cannon. By now you recognize the Spad VII. (Larkins Photo)



3. With its monocoque fuselage, this model was a real achievement in 1931. Its 171 m.p.h. speed made it a popular racer, and it carried U.S. Airmail. It's the Boeing P-12. (U.S.A.F. Photo)



4. This sleek, all-metal craft made its appearance in 1935. With a Pratt-Whitney engine that delivered 950 h.p., it ripped along at 281 m.p.h. Its name? Seversky P-35. (Larkins Photo)



5. And here's a 1948 jet model. Carrying six .50 cal. machine guns and eight 140 lb., 950 m.p.h. rockets, this amazing craft does 600 m.p.h., climbs 535 feet per second. You can't help recognizing Republic's F-84 Thunderjet. (U.S.A.F. Photo)

One of the most important "milestones" in the progress of military aviation has been *aluminum*. Since the early days of flying it has been used in ever increasing quantities to make planes faster, stronger, more powerful.

This forward march of aviation with aluminum has been accelerated by the opening of another dependable source—*Kaiser Aluminum*. Its producer, Permanente Metals Corporation, is proud of the part it is playing in aviation progress . . . proud it has set new standards in the industry for on-time deliveries of highest quality aluminum.

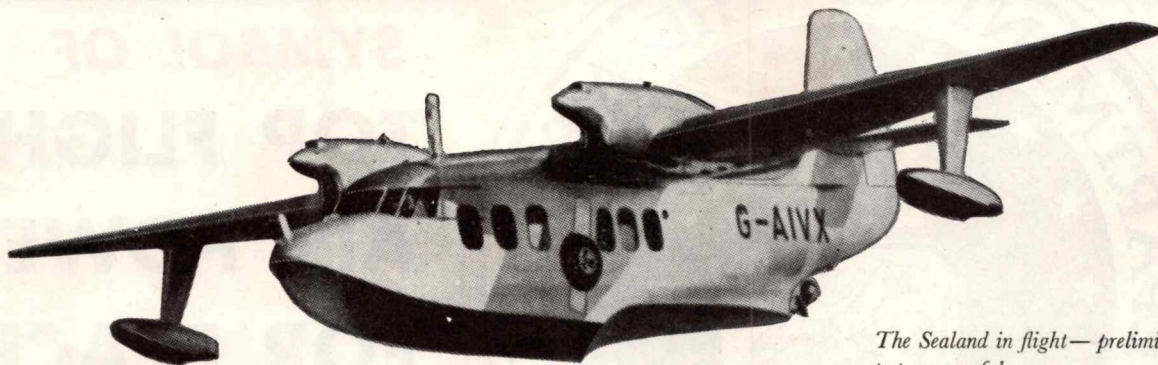
Today every major U. S. aircraft builder uses

Kaiser Aluminum

product of Permanente Metals Corp.

SOLD BY PERMANENTE PRODUCTS COMPANY, KAISER BUILDING, OAKLAND 12, CALIFORNIA . . . WITH OFFICES IN:
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Some Short jottings for airline operators, charter companies, and V.I.P.s



The Sealand in flight— preliminary tests successful

The Sealand steps out...

Successful flight trials

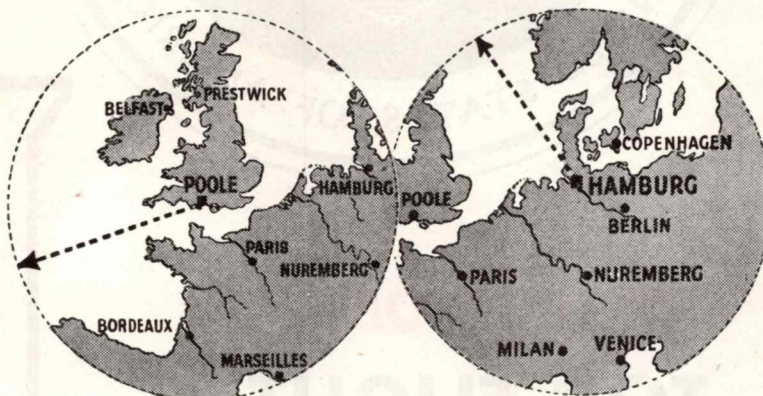
On January 22nd, the prototype Short Sealand made its first water take-off at Belfast after a series of engine runs ashore and afloat.

The preliminary flying tests were so satisfactory, that it has been decided to go forward to complete fitting-out without further tests being necessary.

Good news...

Good news for all who have sent in enquiries about the Sealand is that the first delivery is expected to be made during the Summer.

The Sealand is the ideal all-purpose amphibian, being available for such widely varying purposes as executives' communications craft, an airborne office or showroom, a freighter, for ambulance work, feeder lines and charter services. The payload is 1,400 lb. (or 7 passengers and luggage), with petrol consumption of better than 6 miles to the gallon, with a range of approximately 300 statute miles.



Sealand maximum range-circle of 776 miles. The Sealand operates from any airfield, or from 900 yards of water

FLYING-BOAT PERSONALITIES



Chief Pilot

JOHN STRANDRUD

O.B.E., of D.N.L.

ESCAPING from Norway in 1940 via Sweden, Russia, Turkey, Iraq, India and South Africa to Canada, Captain Strandrud spent some months there training pilots.

He came to England in 1941 and spent three years flying between Stockholm and Scotland with secret agents, political refugees from Norway, and government despatches. For belly-landing a Mosquito without harm to the V.I.P. in the bomb compartment, and for delivering the passenger, in another aircraft, on time in Stockholm, Strandrud was awarded the O.B.E. (Civil).

One of the most experienced and best pilots in Norway, Captain Strandrud is delighted with D.N.L.'s choice of Short Sandringhams for the Norwegian routes.



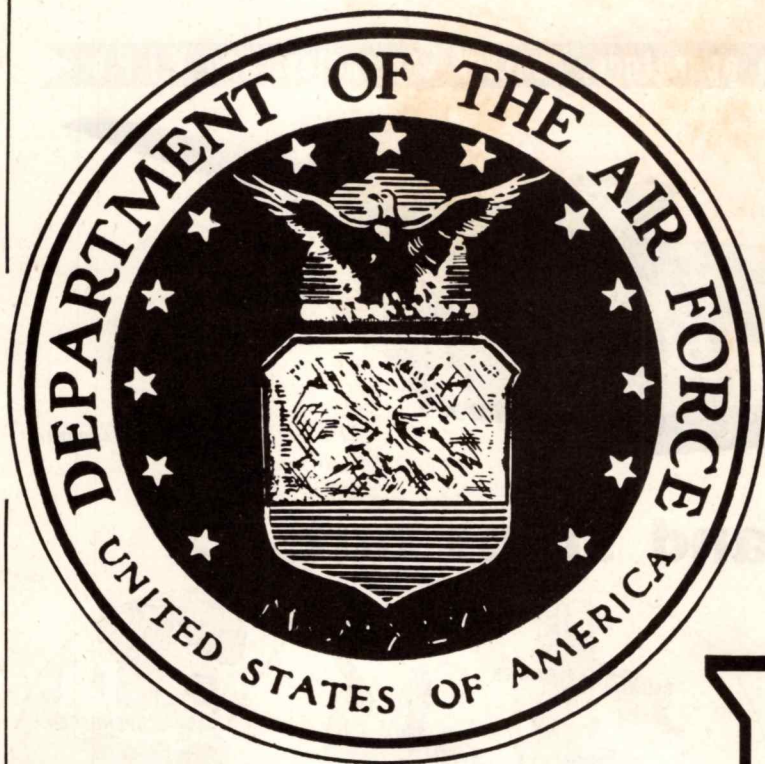
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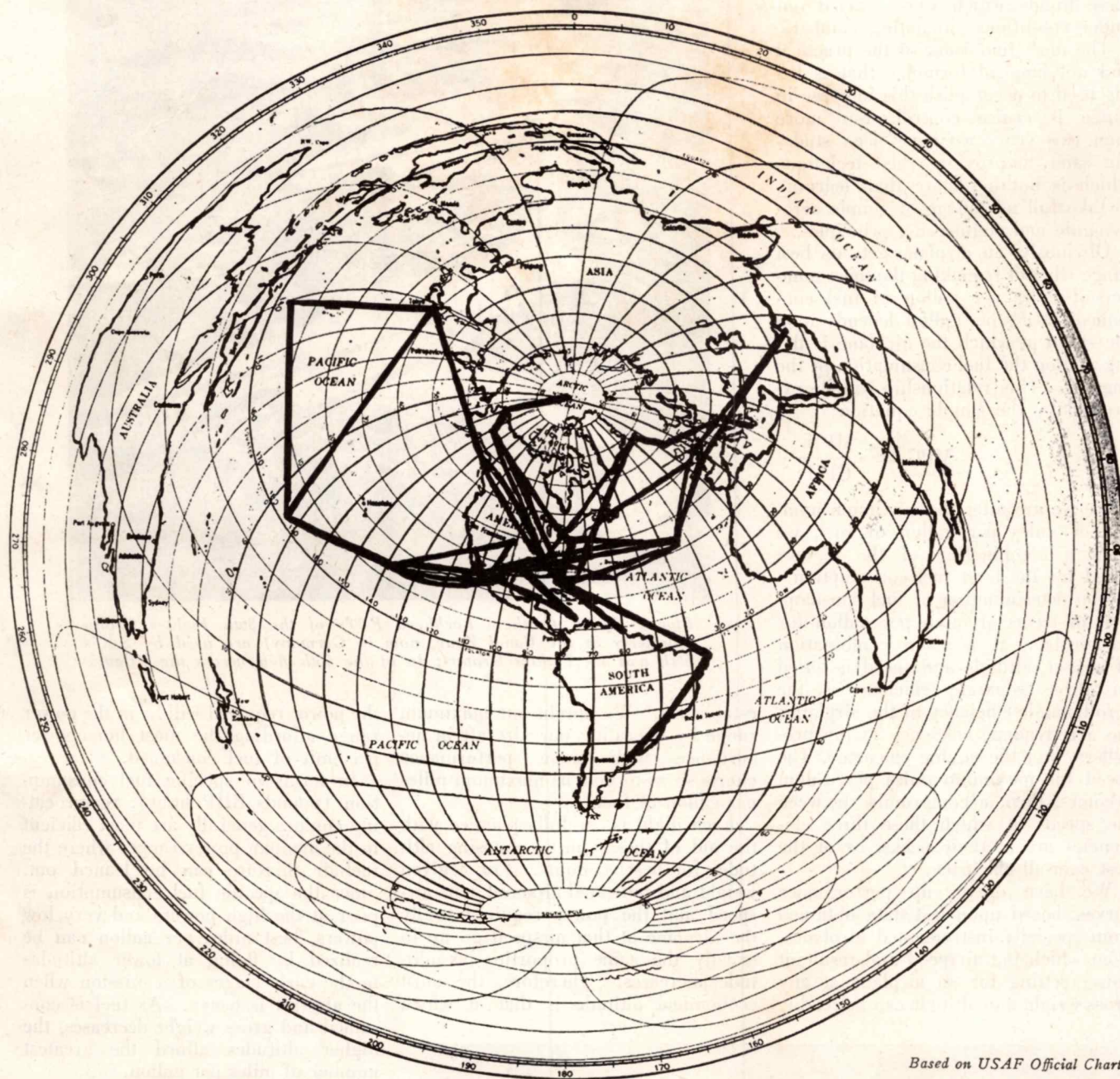
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Based on USAF Official Chart

With the U. S. as center, this equidistant world chart shows extent of Strategic Air Command routine training missions

SHRINKING THE WORLD

COLONEL HEWITT T. WHELESS

Chief of Operations Section, A-3, Headquarters, Strategic Air Command

THERE is no better one-sentence description of the activities of the Strategic Air Command than to say it's busy shrinking the world. Almost every activity of this command is pointed toward pulling the far-distant spots on the globe closer to the United States so that this long arm of our Air Force can, by its ability to reach ever farther in retaliation,

continue to increase its now potent capability to maintain world peace.

This shrinking is not being accomplished by any magic formulae that are actually making the earth's crust smaller. It is being done by consistently extending the range of our aircraft and thus decreasing distances in a travel-time relation.

That we are moving toward our ob-

jective is clearly evident in the fact that, since we began our efforts, we have learned to fly B-29 *Superfortresses* several hundred miles farther than we could during the war. For example, several months back two B-29 crews flew their aircraft on a 4800 statute-mile round trip from MacDill Air Force Base, Tampa, Fla., to Muroc Dry Lake, Calif. And these aircraft weren't

stripped-down, hopped-up airplanes. They were standard service aircraft and bore appropriate bomb loads on these flights which were carried out under conditions simulating combat.

The most important of the practical and not magical formulae that is being used to accomplish this increase in range is cruise control. For more than two years we have been studying and improving this technique which is nothing more than learning to take full advantage of simple aerodynamic and engineering principles.

Obviously, an airplane gets its best range when it is making the most number of miles per gallon of fuel consumed. Miles per gallon depends upon the speed at which the airplane is flying and on the fuel consumption of the engines. This relationship can be expressed by the simple equation:

$$\text{MPG} = \frac{\text{MPH}}{\text{GPH}}$$

Since we are after the maximum number of miles per gallon of fuel, we want a combination of the highest speed for the least fuel consumption.

The determination of fuel consumption in terms of miles per gallon for an airplane at a given combination of weight, altitude and speed is based on three separate efficiencies: the aerodynamic efficiency of the airplane; the aerodynamic efficiency of the propellers, and the engine efficiency. The speed for maximum miles per gallon becomes, then, a compromise between the speeds at which these three efficiencies are at their peaks, or at the best over-all efficiency.

We have drawn up performance curves, based upon test data obtained from specially instrumented airplanes, from which the airspeed and resultant power setting for an airplane at any gross weight and altitude can be readily

established. We obtain our maximum range by operating our aircraft in accordance with these performance charts so as to give us maximum miles per gallon of fuel.

Each flight is carefully planned with the aid of these charts, choosing altitudes for best economy. For a given weight and indicated airspeed, true airspeed and the power required to fly the airplane at that airspeed go up in exactly the same proportion as altitude increases. Therefore, the most economical altitude is that at which

the power required will be in the power range affording the most horsepower per unit of fuel consumed.

In terms of specific fuel consumption (pounds/BHP/hour), reciprocating engines generally are most efficient in the medium power ranges where the fuel-air mixture can be leaned out. Since the specific fuel consumption is poor at the high powers and very low powers, best miles per gallon can be realized by flying at lower altitudes in the early stages of a mission when the aircraft is heavy. As fuel is consumed and gross weight decreases, the higher altitudes afford the greatest number of miles per gallon.

Air-to-air refueling is another activity we are developing to enable us, if an aggressor ever attacks this country, to perform better our global mission of conducting long-range operations in any part of the world at any time, either independently or in cooperation with land and sea forces; of conducting long-range reconnaissance over land or sea; and of performing such sea-search and anti-submarine operations which we may be directed to accomplish.

For reasons of security, our methods of accomplishing air-to-air refueling cannot be enlarged upon. It can be said, however, that air-refueling units have been activated.

(Continued on page 157)



Planes similar to these Lockheed F-80's of the 36th Fighter Group (formerly in the Canal Zone, now in Germany) are used by SAC's 56th and 4th Fighter Groups; 16 of the 56th flew across the Atlantic



USAF photo

Strategic Air Command now operates 13 of the huge Convair B-36A's, with 12 more built, and total order 95. General Kenney reported that recent tests equal or surpass previously announced performance figures on speed, range, bomb-load

AIR-FORCE-IN-BEING

HON. W. STUART SYMINGTON

Secretary of the Air Force

ALTHOUGH the autonomous United States Air Force celebrates its first birthday this September, it is far from a year old infant starting out on its career. The importance of air strength to our nation has been demonstrated over a span of years and the American people today do recognize that "air power is peace power."

In the years from 1943 to 1945 the world saw United States air power as a tower of strength to the allied nations and a terrifying force to our enemies. Then after V-J Day, with the hope for peace rising throughout the world, our Air Force was diminished in striking potential.

★ ★ ★

Recently, however, our nation, aware of threats to peace in the world situation, has, through the Congress, given a charter to the Air Force that provides for an effective Air-Force-in-Being. Today our Air Force organization of 390,000 offices and men is developing towards our authorized strength of 502,000. With the funds granted for the fiscal year we will buy 2201 modern aircraft. We still have a long way to go before we are sure to have an Air Force that can guarantee the peace against aggressors, but the course has been laid out.

★ ★ ★

The American people have recently seen in Berlin an example of the use of air power to preserve in peace the freedoms for which we fought in war. On June 21 the normal flow of supplies to Berlin was cut off. The canals, freight lines and highways that had supplied two and a quarter million people in the German capital were suddenly closed to traffic. A political victory was being sought out of an economic strangulation of Berlin. Within a few hours, however, what may well become the greatest air transport operations ever known was underway. Before a week had passed, nearly one hundred C-47 transport aircraft began "Operation Vittles" with round-the-clock flights from the Rhein-Main and Weissbaden Air Force Bases. From Alaska, Hawaii, the Caribbean and Continental United States, four-engined C-54 airplanes came to assist in the air lift. Unfavorable weather forced pilots to fly on instruments for nearly one-third of the time they were carrying out the operation. Despite this, nearly four million air miles were covered in carrying to Berlin during the first month nearly 32,000 tons of urgently needed supplies.

The growth of "Operation Vittles," in which British and French transports assisted United States Aircraft, is an outstanding example of our Air-Force-in-Being in action. The world cannot but recognize that air transport is an important aspect of the over-all air power which we in America realize we must maintain.

★ ★ ★

Our complete objective for air power covers many factors. It means combat and transport aircraft and trained crews to fly them; expert maintenance crews and



W. Stuart Symington

well administered logistic lines to supply vital equipment; thriving commercial airlines; a healthy aviation industry; the research laboratories of business, government and our academic institutions; and above all the genuine support of the American people.

★ ★ ★

In the year that lies ahead, the second year of the United States Air Force's autonomous existence, we shall devote all of our energy to the perfection of our organization within the means at our disposal. We shall train our airmen with the utmost care. The quality of the man can be as decisive as the quality of the machine. We shall pursue, with the funds available, a vigorous research and development program in an effort to develop aircraft and equipment finer than any in the world. We shall continue to plan, and endeavor to take the steps our planning indicates, to insure a healthy American aircraft industry that would be able in time of need to provide the Air Force with the latest types of aircraft in proper quantities. Finally, we shall carry out our program with scrupulous attention to the best principles of business management so that our resources will be utilized with the utmost efficiency and so that the taxpayer will receive full value for his tax dollar.

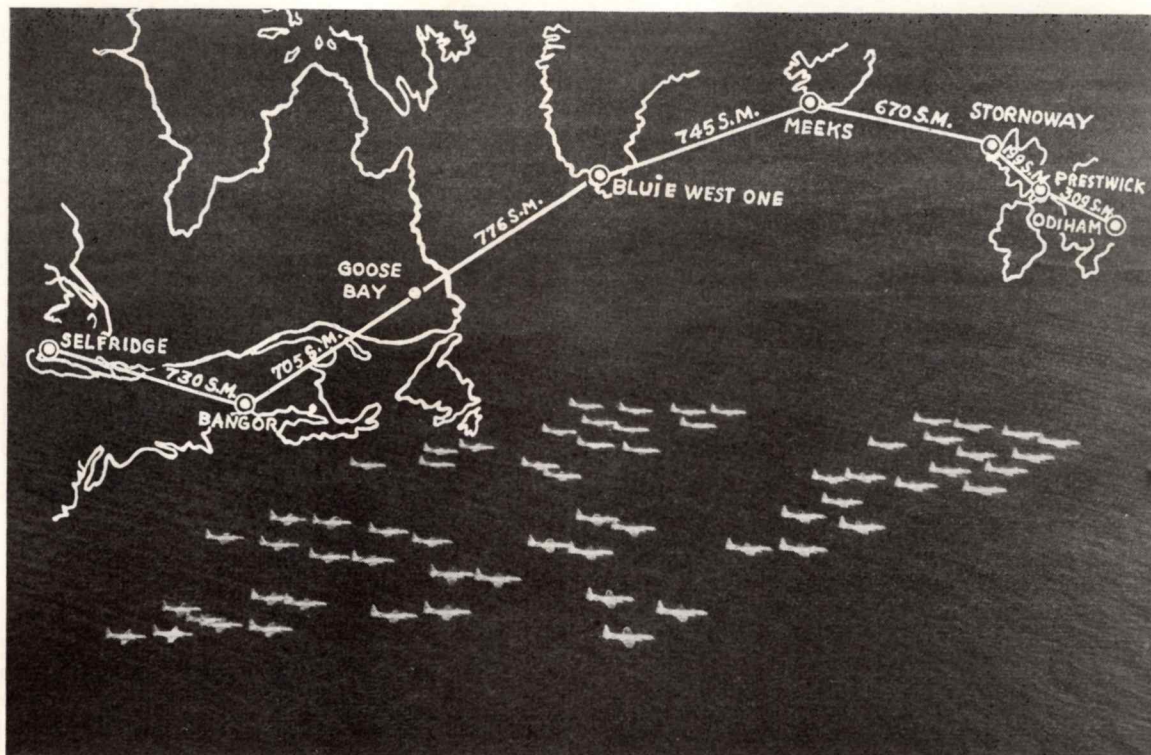
★ ★ ★

Air Power is Peace Power only when the force that wields it is adequate to the task. America has taken the first steps to insure that its Air Force will be able to discharge the task assigned to it. America can proceed with its positive program for peace in the assurance that its Air Force will justify the faith thus placed in it.

About the Author

W. STUART SYMINGTON, a native of Amherst, Mass., was head of Emerson Manufacturing Co. when he was appointed chairman of the Surplus Property Board in 1945. He was later named Administrator of the Surplus Property Administration and then Assistant Secretary of War for Air.

After passage of the National Defense Act of 1947, he was appointed the first Secretary of the autonomous Air Force.



Route of the "Shooting Stars" on the first west-east transatlantic crossing by jet planes, showing distances between hops. Largest formation of jet fighters ever photographed on overwater flight is this group of F-80's from the 36th Fighter Wing, Canal Zone, later shipped to Germany for duty

F-80's Across

JACK POWELL

ON JULY 20, 16 American jet fighter planes tore across the RAF base at Stornoway, Scotland, in brilliant sunshine to complete the first west-east crossing of the Atlantic by jet aircraft.

One by one, the Lockheed *Shooting Stars* from the war famous 56th

Fighter Group at Selfridge Air Force Base, Mich., dragged the runway at speeds of 450 miles an hour, then came in to perfect landings.

Thus ended a historic flight. But in long-range terms of men and machines, in the uncertainty of the future, what did this mean to America and its air

force? Was the flight successful from all angles? Could the venture mean that a practical route was established for the future air shipment of jet aircraft to Europe?

The answers to these questions are based on conversations with the men who flew the F-80's across the Atlantic, and impressions gathered along the flight. These all build up to a conclusion that for some time at least, ferry flights by jet aircraft are impractical, sensational as they are.

By that conclusion, it is not meant that our jet aircraft are undependable and cannot be relied on to fight their way across an Atlantic route.

But the truth of the matter is that jet aircraft, on such a trip, can only fly in good weather, and because of that, must wait until all the cards are in their favor before taking off.

The very purpose of our jet flight, which began from Selfridge on July 12, was to determine the feasibility of ferrying jet-propelled planes to England and Germany, and to study the logistical and operational problems involved in such a mission.

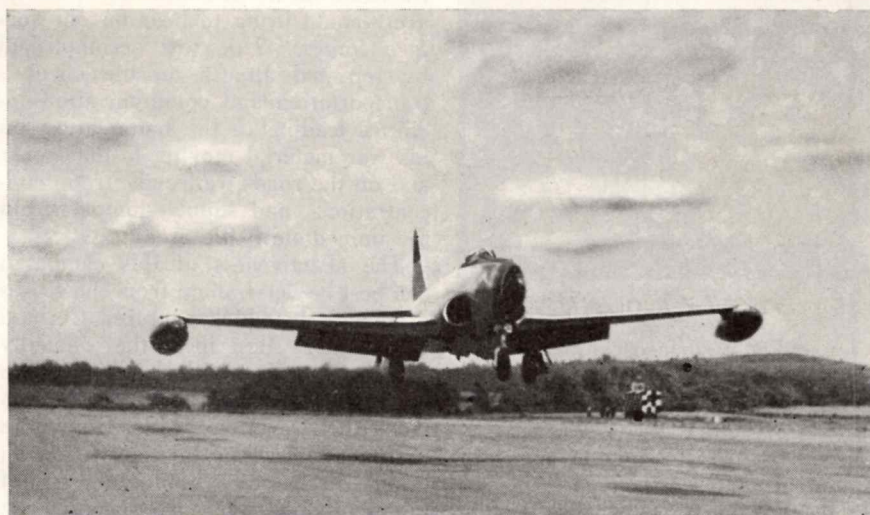
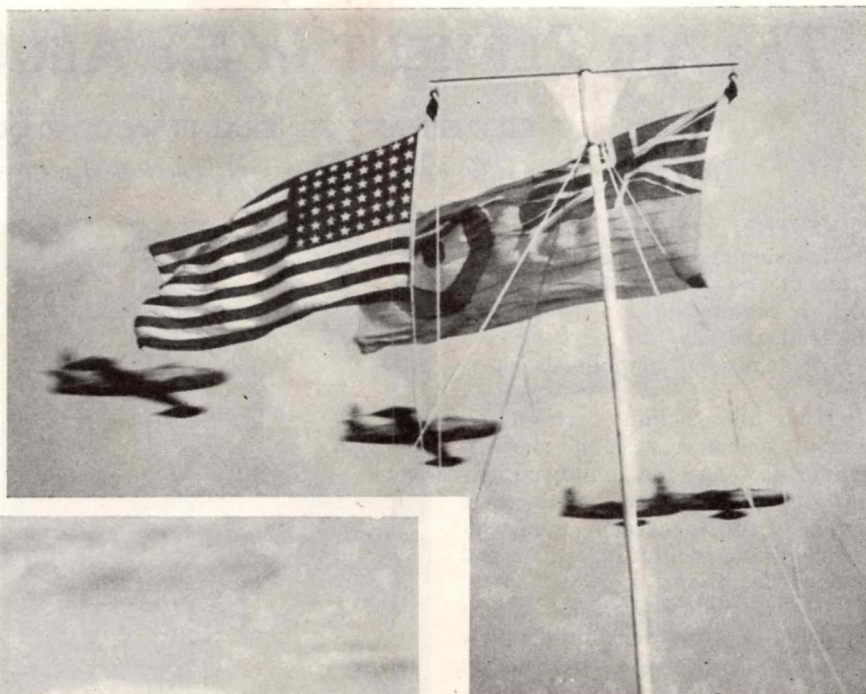
As far as the flight itself was concerned, it went off like clockwork. The F-80's performed exceptionally well, so flight leader Lieutenant Colonel David



U. S. Air Force pilots appeared on BBC television show after landing at RAF Station near London. Lt. Col. David Schilling of Travers City, Fla., commander of the flight, is second from left

Schilling reported. At Dow Air Force Base, Bangor, Maine, one of the jets required minor repair, while at Goose Bay, another needed a new engine. That was all. The problem of supplies was all worked out in advance. At each stop—Dow Air Force Base; Goose Bay; Blue West One; Meeks Airport in Iceland; at Stornoway—fuel was laid away in advance, and all that was required was the refuelling of the jets and the feeding and resting of the men involved in the operation.

But the big problem was the weather, and that, in the opinion of observers, makes future jet fighter flights across the Atlantic impractical.



Lt. Col. David Schilling, flight leader, lands at the RAF Fighter Command base. Above: F-80's of the 56th Fighter Group fly low over Odiham Station prior to landing after historic flight across the North Atlantic

Obviously, in the course of a crisis, the weather may run second to the urgency of a situation, and quite possibly certain risks might be taken which Colonel Schilling refused to even think of.

But for all intents and purposes, the weather is such a major factor in future flights that jet missions are faced with certain delays and stopovers, especially over the North Atlantic.

Without going into too much detail on this, here are some of the factors involved. Fuel consumption at the cruising speeds of 400/450 mph is highly critical, as this is well below the point where the turbojet engine begins to pay off in efficiency (over 600 mph). In bad weather, formation flying is very difficult, but for small single seater aircraft highly important. It is all too easy to get off course owing to failure of radio compass, etc., and at 400-odd mph it does not take many minutes to become a lost sheep. Owing to the narrow confines of the jet fighter cockpit, triangulation and other standard navigation techniques to help get back on course are very difficult.

Finally, Blue West One leaves much to be desired for a jet fighter landing field with its 4500-ft uphill landing strip, requiring an abnormally high approach speed, proximity of high mountains, etc. However—the trip was made, and it may well be that in the course of time many of these problems will be at least partially licked.

Even when the weather was marginal, Col. Schilling, a capable, cautious, energetic airman who bagged exactly 33½ Nazi planes in Europe, kept his fliers on the ground. Such was the case all along the route.

Time and again he and his men, 14 of whom flew *Mustangs* in World War II, swore and cursed at the weather. But time and again they only flew under good or perfect conditions. The very limitations of the jet plane forced them to wait. But once they flew, reminisced Col. Schilling over a beer at the base in Furstenfeldbruck, Germany, "We flew like eagles with their tails on fire."

Originally, the flight across the Atlantic to Germany for combat training maneuvers, was to have begun on July

14, but Col. Schilling got reports of good weather, and so on July 12, two days ahead of schedule, the 16 jet planes roared away from Selfridge to Dow—a distance of 830 miles. This they did in one hour and 50 minutes. Late that afternoon, with the weather still holding good, the jets headed for Goose Bay and made the 714 miles in one hour and 55 minutes. On this leg, though, strong headwinds slowed the planes down.

And it was at Goose Bay that the first of the weather problems cropped up. And if that wasn't bad enough, it was a situation in which our own State Department figured. Let bygones be bygones, the jet airmen now say, but if the boys in the striped pants hadn't interfered, things would have been different.

Shortly after the jets landed at Goose Bay, Col. Schilling received one of the great disappointments of his life. With the weather all in his favor, he and his men were expecting to take off for Blue West One early Tuesday morning on the first leg of the ocean flight.

Hardly had Schilling climbed from his *Shooting Star*, however, when he was informed that his fliers would have to hold at Goose Bay until the six British *Vampire* jet fighters could finish their trip across the Atlantic, then in progress.

Our airmen were furious. This type of Alphonse and Gaston diplomacy, provoked by the State Department with America oddly enough playing both roles, found no takers.

Col. Schilling sent off a wire to Washington asking for permission to

(Continued on page 144)

The AIR ELEMENT in the AIR-GROUND TEAM

LIEUTENANT GENERAL ELWOOD R. QUESADA

Commanding General, Tactical Air Command

IT IS THE mission of the Tactical Air Command to provide and operate that portion of the Air Force which is maintained for cooperating with land and sea forces in the conduct of land and amphibious operations.

It is our responsibility to train and maintain combat, service, and supporting units necessary for joint operations with ground and naval forces. We must be ready to execute, either independently or jointly, immediate and sustained operations.

If, in any future war, the results should not be decided in the first few hours, days, or weeks by strategic bombing on the part of our forces or those of the enemy, we believe that tactical air power's greatest contribution toward the over-all effort could be made by preventing hostile armies from advancing and engaging our surface forces in action.

The belief that tactical air power can harass, hamper, and even destroy a hostile army to the extent of rendering it impotent and incapable of aggressive action is not visionary day-dreaming. It is the natural projection of the doctrine for employment of tactical air power which was evolved during the past war. This doctrine, developed step by step under the pressure of war, proved its capabilities in the final assault on Fortress Europe. It encompassed three salient features, namely: (1) the gaining of local or general air superiority as a prerequisite



Lt. Gen. E. R. Quesada

to launching a surface campaign, (2) isolation of the enemy within the battle area, and (3) direct cooperation on the field of battle.

In the future, the first principle of gaining air superiority will be necessary regardless of whether remotely controlled missiles or conventionally controlled aircraft are used. Security from missiles launched through the air must be achieved to permit surface forces to maneuver and prosecute the campaign with a minimum of interference. This is extremely important to a surface force and to an air force, since it permits the most advantageous

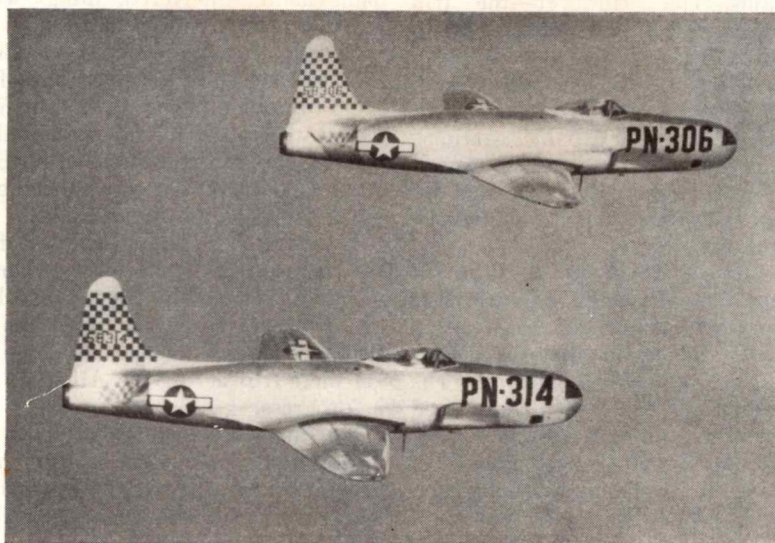
location of logistical centers, the movement of forces in conformance with the tactical situation and the concentration of forces without fear of observation and sustained attacks.

At the cessation of hostilities of the past war, the second principle (isolation of the enemy within the battle area) had been developed and proved to the extent that it materially detracted from the strength that a hostile army could bring to bear on our surface forces. This was accomplished by repeated attacks on the enemy's transportation and communication facilities leading to the battle area; on his war material moving to the front; and on the roads, railroads, troop concentrations, and supply dumps within the immediate battle area.

The effectiveness of this campaign can best be determined from the scores of reports in which captured German commanders described the difficulty of moving over roads leading to the front, and by the failure of troops to reach their positions in the front lines at full strength, or in time, or in an orderly fashion. Representative of these is the story told by General Fritz Bayerlein, commander of the Panzer Lehr Division, who said that his unit took eighty hours to make what normally was a 12-hour trip, and that it arrived with only 50% of its original firepower. Von Rundstedt complained that the incessant fighter-bomber attacks on roads and railroads, as well as bomber attacks on larger communications facilities, prevented the shifting of reserves which could have defeated the Allies on the beaches.

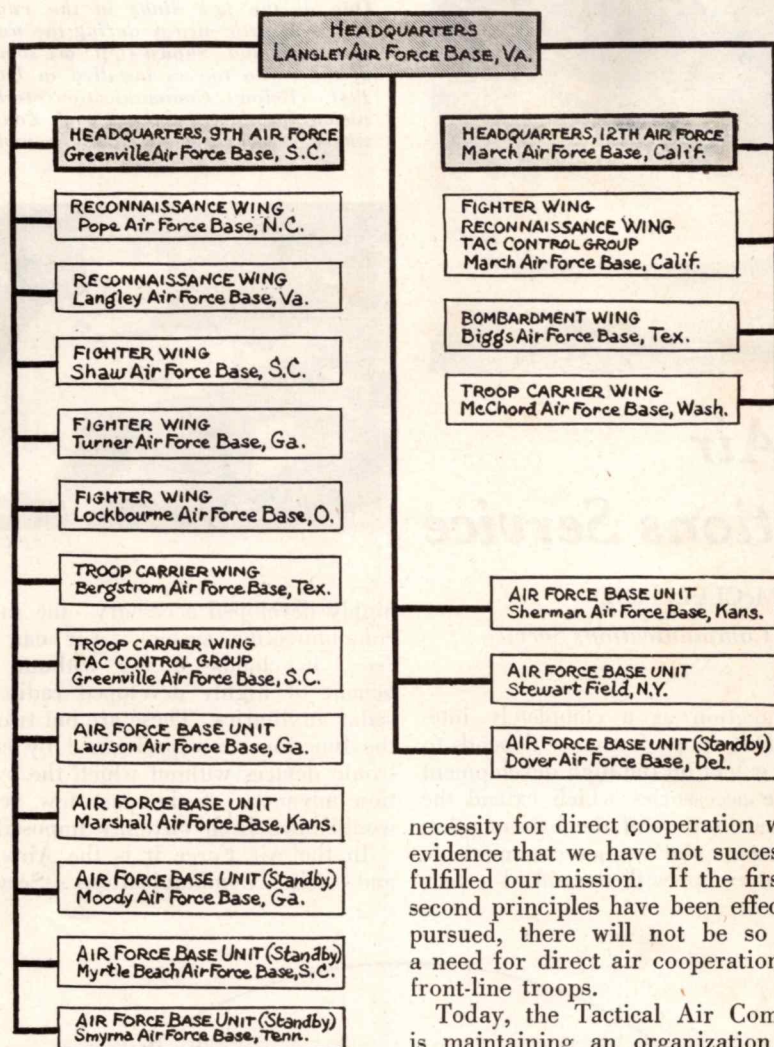
Forestalling the Enemy

I repeat, that at the end of the last war we had proved that tactical air power could seriously weaken the hostile army. Now, we are attempting to go a step farther and improve our tactics by attacking the hostile forces long before they make contact with our surface forces. It is our intention to assist our own armies further by attempting to deny the enemy ability to gain close contact. We believe this can be done. It requires intensification of, and greater emphasis on, the isolation campaign as pursued in the last war. When our surface forces begin the advance into enemy territory, an isolation campaign that has been vigorously pushed beforehand will make it possible for our forces



Lockheed RF-80 reconnaissance planes of the Tactical Air Command's 363d Reconnaissance Group at Langley. F-80 fighter-bombers carry 50-cal. machine guns, bombs and high-velocity aircraft rockets

THE TACTICAL AIR COMMAND



to advance much further before encountering stiff organized resistance.

Let me make it unmistakably clear that we desire to assist, rather than supplant, the ground forces by the development of the tactical air-power doctrine. There is no doubt about the need of powerful ground forces in any war; but it seems far more economical, both in human and monetary values, to paralyze the enemy's means of communication, sources of industrial support, and ability to engage in combat, than to pursue a long-drawn-out surface campaign. The final objective is to subdue the will of the adversary with a minimum of expenditure in personnel and equipment and, if possible, before opposing surface forces collide.

When surface forces constitute a major element on the field of battle, tactical air power must be equipped and prepared to provide maximum assistance in the prosecution of the campaign, in order to effect a quick decision. It is here that the third principle of our concept—direct cooperation on the field of battle—comes into action. However, we feel that the

necessity for direct cooperation will be evidence that we have not successfully fulfilled our mission. If the first and second principles have been effectively pursued, there will not be so great a need for direct air cooperation with front-line troops.

Today, the Tactical Air Command is maintaining an organization composed of airpower especially adapted for air war in conjunction with surface operations and surface objectives. While our planning is directed toward the goal of holding a hostile army at

bay, we are not forgetting that we must also be prepared for close cooperation with surface forces in action.

To facilitate closer understanding and cooperation between TAC and the Army Field Forces, the headquarters of the two organizations are located near each other, with TAC at Langley Air Force Base, Virginia, and the AFF at Fort Monroe, Virginia.

East and West

In order to carry out its mission, TAC has two tactical air forces. The Ninth Air Force, commanded by Maj. Gen. William D. Old, has its headquarters at Greenville AF Base, South Carolina; its Wings are located in the eastern portion of the United States. The Twelfth Air Force, commanded by Maj. Gen. Glenn O. Barcus, is located at March Air Force Base, Calif., with its units in the western part of the country.

The types of aircraft employed by these two air forces fall into four major categories (in addition to miscellaneous small units): fighter-bomber, reconnaissance, light bombardment, and troop-carrier. Here, economy has forced us into a situation which is not ideal. Troop-carrier aviation in combat would be concentrated in a separate organization, but, in order to eliminate the overhead of another headquarters during peacetime, troop-carrier units have been assigned to the Tactical Air Command for training and development. In our activities along this line, we are doing everything within our power to help the Army achieve its announced goal of eventually making entire field armies air-transportable. This effort is reflected

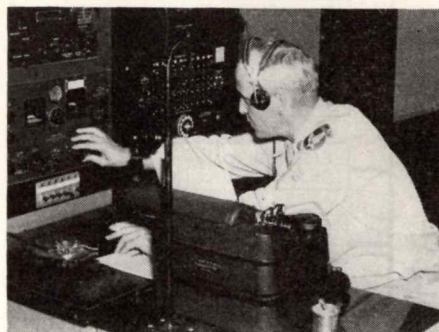
(Continued on page 131)



Sights like this were common as Nazi forces in France fell back before the Allied air-ground team, consisting of American and British armies and their related Tactical Air Commands, such as Quesada's 9th TAC



One of the first links in the vital North Atlantic airway during the war was Greenland. Shown (left) are some of the radio towers installed in late 1941. (Below) Communications technician on duty in the Canal Zone, where treacherous weather abounds



USAF Photo

The Airways and Air Communications Service

MAJOR GENERAL H. M. McCLELLAND

Commanding General Airways and Air Communications Service

MOST people are fairly familiar with the rapid technological improvements of the modern airplane, but are not all aware of the extent to which such improvements are due to the great advances made in the so-called accessories field.

Thus, higher speeds and altitudes became possible upon, among other things, refinement of aircraft fuel-metering and control devices; greater range came with improved ignition and better fuel; dependable round-the-clock flying awaited the advent of electronic communications and navigational aids. The airplane's all-weather flight and its remarkable performance over either tropics or Poles were made possible only by the perfection of the accessories which were capable of dealing with such varied conditions.

The point is best made by comparing an airplane with a man. The airframe might be considered his skeleton and body, and the powerplant his lungs, heart and muscular system; but the accessories are not, in this analogy, his clothes, his jewelry and his cigarette lighter.

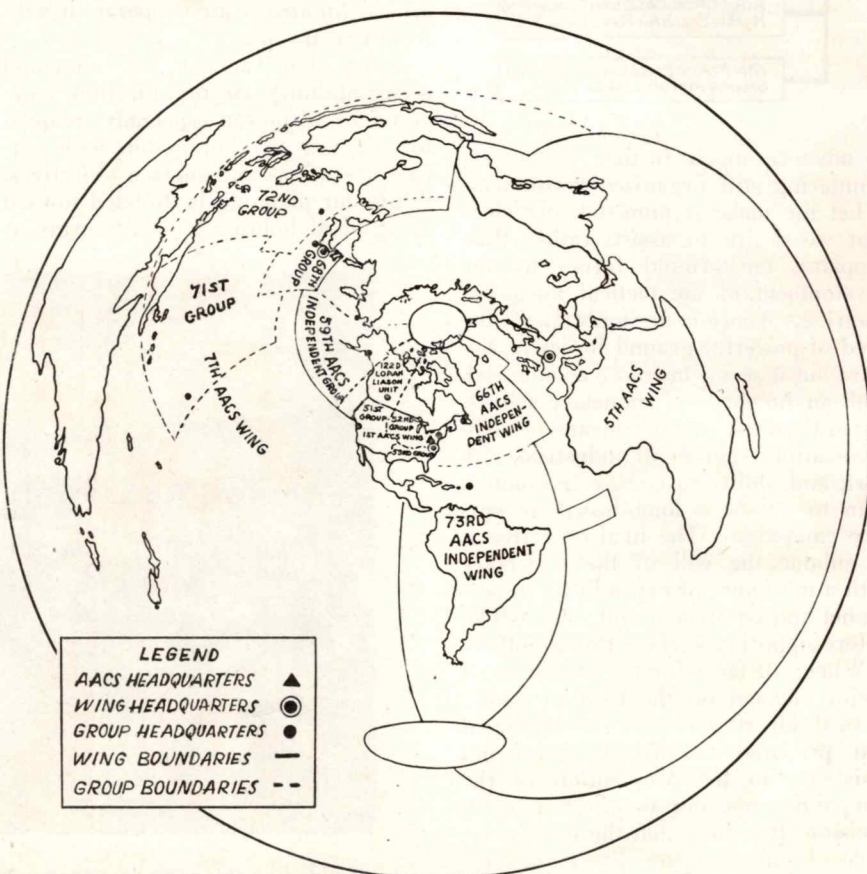
Aircraft accessories are more important than that, for they comprise all the instruments and devices which perform for the aircraft the great variety of functions which the brain, the nervous system and the sense organs take care of for man. Therefore, in aeronautical nomenclature, the nervous system, the senses of vision, hearing and communication, along with the various controls which make the human body articulate, are classified merely as "instruments and accessories."

However, since a modern airplane

must function as a completely integrated unit, its performance depends to a great extent on the high development of these accessories which extend the inadequate senses of the human pilot. The human pilot cannot communicate by voice except with the aid of a very

highly developed accessory—the radio communication system. Nor can he "see" in clouds or fog without the benefit of highly developed radio or radar auxiliaries. These are but two of the functions now performed by electronic devices without which the aviation advances of the past few years would have been virtually impossible.

In the Air Force it is the Airways and Air Communications Service



Global chart indicates the worldwide activities of AACS which provides 24-hr service for Air Force pilots anywhere along its communications chain

which provides the communications and navigational aids which are the eyes, ears and voice of the Air Force pilots, and which make of the modern aircraft an effective, controlled instrument for peaceful or warlike pursuits.

1. *What is AACS?* — The Airways and Air Communications Service (AACS), is the Air Force agency charged with the responsibility of providing communications and navigational aid facilities, together with air traffic control services as required, to facilitate the safe and expeditious movement of military aircraft along air routes within areas essential to the accomplishment of the mission of the U. S. Air Force. To this end, it guides and informs aircraft during the entire length of their flights. And as the importance of facilitating the safe movement is essentially the same in peacetime as in war, the quality of service must be maintained to the maximum possible degree at all times.

AACS stations provide 24-hour services for instant use by Air Force pilots anywhere along its communications chain. Today the airman can fly "blind" in weather that formerly would have kept him grounded. Men of the AACS relay weather data with which the pilot is briefed. From airdrome control towers they direct traffic for his safety. From ground-air positions they pass on newest weather reports, emergency information, further instructions, or handle requests for a particular type of service at the pilot's destination airport.

Safety Network

Over point-to-point circuits, the AACS sends needed flight information along the route, which is itself marked by AACS ranges, homing beacons, direction finding and Loran stations—all of them safeguards over the trackless airways. And at the end destinations instrument approach systems and ground controlled approach units are ready to bring the pilot down through the lowest and thickest ceiling. AACS operates whenever and wherever air communications are needed for the United States Air Force.

2. *Whom does it serve?*—The airways communications system renders service either directly or indirectly to air operations of all types (including, when requested, those of the other Services and civil airlines) and is therefore essential to the Air Force in discharging its mission effectively. During the War, it served all the numbered Air Forces as well as over thirty other different agencies.

At the present time it serves, among others, the Tactical Air Command, Strategic Air Command, Military Air



USAF Photo

The Funabashi Transmitter Station on Japan's main island of Honshu is an important element in the communications system for USAF planes in the Far East

Transport Service, Air Weather Service, Flight Service, Caribbean Air Command, Alaskan Air Command, Far Eastern Air Force, United States Air Force Europe, and Air Defense Command as well as, in many instances, the Navy, Marines, Coast Guard, the Air National Guard, and Air Reserve.

3. *Organization* — The AACS was organized to provide an integrated airways system, strategically controlled under a single command answering directly to the top level of Air Force Command. The present organizational structure is the same type, on a re-

duced scale, as that employed during the past war.

From a VJ Day peak of 8 Wings and 29 groups, with a Command Headquarters at Asheville, N. C., AACS now operates from the Command Headquarters at Washington, D. C. with the 7th Wing at Tokyo; 5th Wing at Wiesbaden, Germany; 59th Group at Ft. Richardson, Alaska; 66th Group at Ft. McAndrews, Newfoundland; 73d Group at Ramey Air Force Base, Puerto Rico; and 1st Wing at Langley Field, Virginia. The strength and soundness of this structure has been proved by its ability to expand rapidly in time of necessity and to weather the hectic days during the critical period of demobilization.

"Systems Concept"

This stability is due to the fact that AACS is organized on the principles of the *Systems Concept*, a concept which embraces two fundamental premises: *first*, that success in operating common-use type facilities serving a large area varies in direct ratio to the degree that activities at one location are coordinated and integrated with similar activities at other locations; *second*, that functions of planning, coordinating, integrating and managing, including the provision of uniform operational methods and procedures, are best achieved by establishing the requisite communications facilities as a system at the highest

(Continued on page 150)



Maj. Gen. H. H. McClelland

The INSPECTOR GENERAL of the AIR FORCE

MAJOR GENERAL HUGH J. KNERR, USAF
Inspector General, USAF

AS A CONSEQUENCE of wartime experience and the need for adapting the Air Force to peacetime employment, it was determined late in 1947 that a new concept of "Inspection" was required. To accomplish this, the writer was charged with the mission of creating the Office of Inspector General, USAF.

It was apparent that, if the Air Force was to be light on its feet and make the most of its time and space characteristic, it was essential that the Chief of Staff, United States Air Force, should be able to extend his eyes, ears and will down to the lowest echelons of activity.

The three-dimensional sphere in which the Air Force operates dictates that a specialized inspection service be in existence. Decentralization of operation is required with close, centralized control of policy.

Three Directorates have been established at Headquarters, United States Air Force, under the Inspector General. They are: The Air Inspector, Air Provost Marshal and Director of Special Investigations. Each of these activities is headed by a General Officer who reports directly to the Inspector General.

Under the direction of the Inspector General, USAF, the Air Inspector is charged with the determination of combat worthiness of the Air Force. By proper inquiry he will inform the Chief of Staff, USAF, and appropriate commanders of the status of all matters affecting the tactical, technical, logistical, and administrative efficiency and flying safety, and, by proper dissemination of information and (where appropriate) by suggestions or recommendations, assist all commanders in improving the efficiency and effectiveness of the Air Force as a whole.

To carry out his responsibilities, the Air Inspector establishes doctrines, facilities, techniques and procedures necessary to provide an inspection program adequate to assure rendering a constructive service to the Secretary of the Air Force, the Chief of Staff, USAF, and appropriate commanders. He directs and operates a flying-safety program providing for analysis of aircraft accidents and the dissemination of accident information in the interests of flying safety. He determines the status of training and readiness for combat or for foreign assignment of Air Force units, crews and individuals. He assists commanders and



Maj. Gen. Hugh J. Knerr

their personnel in performance of their duties by supplying information and (when appropriate) by suggesting ways and means of improving practices and procedures.

The Air Inspector has overhauled his organization and eliminated those activities that do not bear directly upon the production of combat-worthy units throughout the Air Force. This inspection function is based upon the use of experts in each specialized field

and not by jacks-of-all-trades attempting to cover all fields. The objective of these inspectors is "to help the boys out, not to skin them."

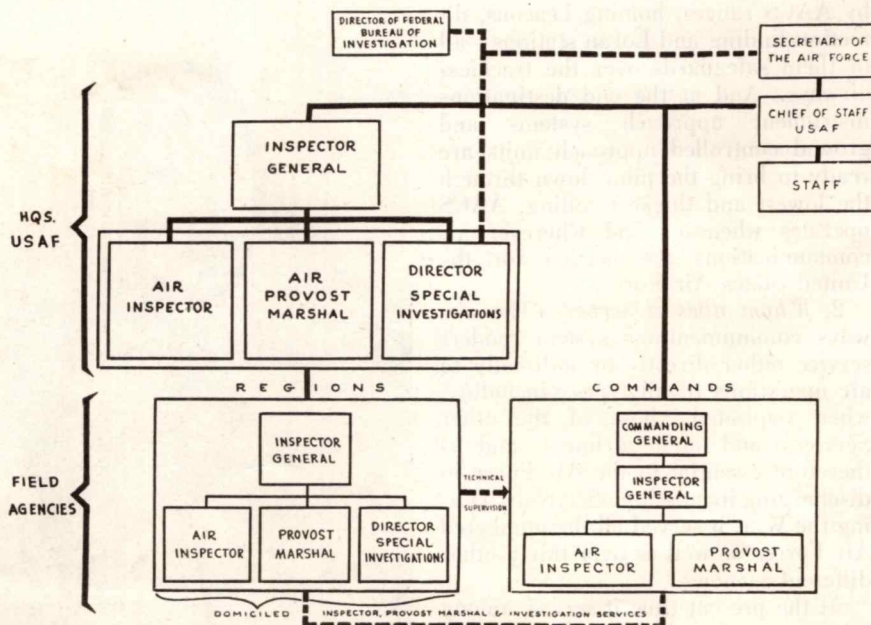
In order to maintain the basic principle that the chain of command must be strong and contain no potentially weak links, two other Directorates were established. One of these, the Air Provost Marshal, was taken into the Inspector General's family and charged with the job of supervising the enforcement of discipline to the end that commanders might be fully supported through essential discipline, but a discipline that suits the sensibilities of the American citizen.

The Air Provost Marshal, under the direction of the Inspector General, USAF, exercises supervision and inspection responsibility over all matters pertaining to the maintenance of military discipline and enforcement of security in the USAF.

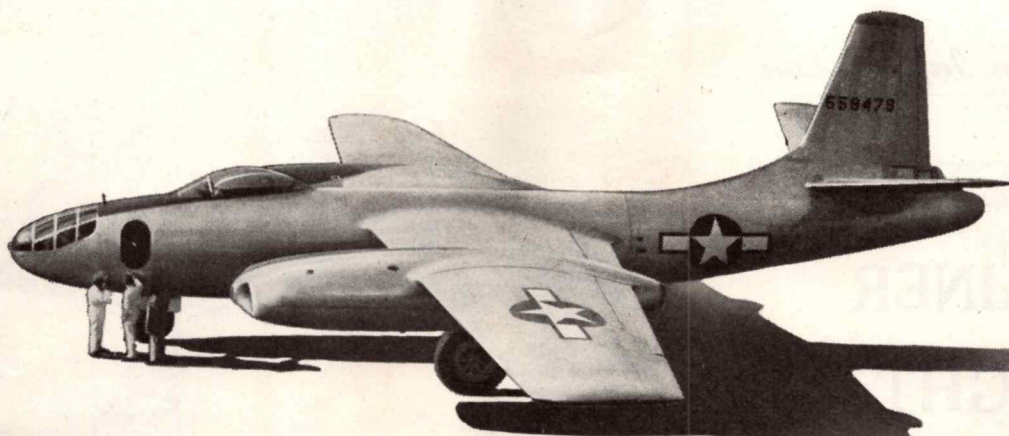
He formulates plans, policies and procedures for the organization, operation, training and equipment of military police; apprehension of absentees; maintenance of law and order; prevention and suppression of crime; operation and administration of guardhouses and stockades and the treatment and rehabilitation of garrison prisoners.

He enforces all phases of the USAF internal-security program including the

(Continued on page 154)



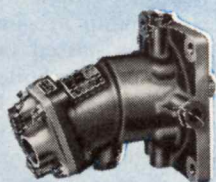
Inspector General of the USAF



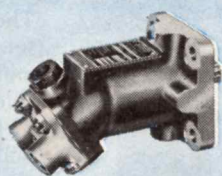
North American Aviation's B-45

Uses

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Vickers Model PF-3909 Series
Constant Displacement Piston
Type Pump



Vickers Model MF-3906 Series
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Type Motor



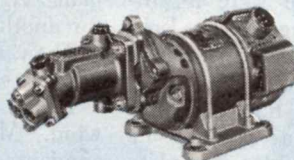
Vickers Power Brake Valve
Model AA-13150 Series has
true "hydraulic feel"



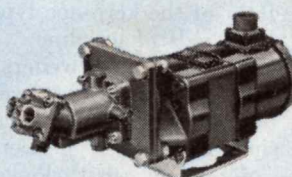
Vickers Model PF-3911 Series
Constant Displacement Piston
Type Pump



Vickers Model AA-34540 Series
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Vickers Model AA-19020
Motor-pump



Vickers Model AA-19024
Motor-pump



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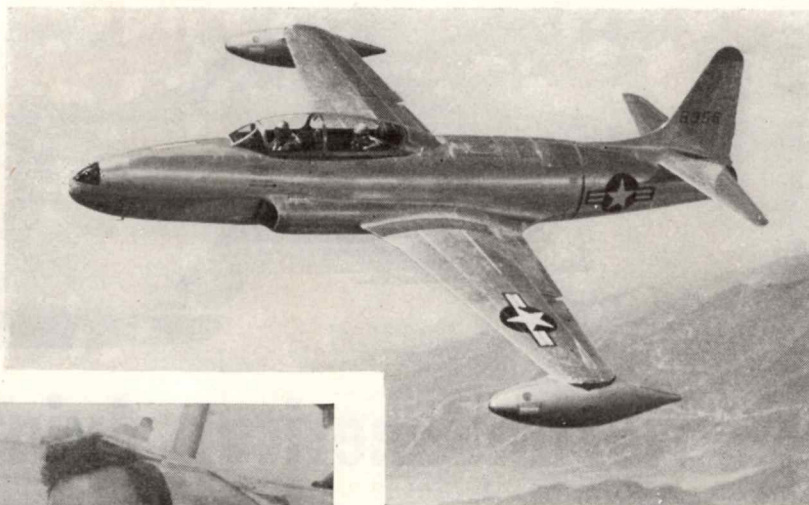
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3346

JET TRAINER FLIGHT



USAF's new two-place jet trainer, the Lockheed TF-80C, demonstrated for the press at Andrews Field



Tony Levier (right), Lockheed's chief engineering test pilot, briefs Kendall K. Hoyt, AERO DIGEST Washington editor, before take-off in TF-80C. Flight was Hoyt's first in jet plane

JET FLIGHT for a few members of the press was arranged a few weeks ago by Lockheed and the Air Force in a TF-80C at Andrews Field near Washington. Your correspondent thus had the privilege of being one of the few civilians jet-borne.

This first 2-place jet plane, designed for fighter training, was put through its paces by Tony Levier, famed test pilot. It's a yard longer than the single-seat F-80, a compact bundle of streamlined power.

As I waited my turn, I looked at the simple cockpit layout of an F-80 on the ground, its hood open with belts of fat cartridges on display.

A young lieutenant increased my respect for the ship by telling how he broke off a wing tank and two feet of wing tip in low flight but came in safely under perfect control.

Then a parade of F-80's rolled majestically around the taxi strip, hot fumes billowing behind, to fly over Pershing's funeral. That would be the

picture in emergency . . . our fighters, ready . . . but we need so many more.

Tony's ship whooshed over us, skimming like a falcon, and presently came in to fuel. There were no inhibitions against smoking nearby. Fuel of the kerosene type is free of the hazards of gasoline.

As other writers told how it felt to go aloft, I was excited as a youngster on a first roller-coaster ride. Complete with crash helmet and a lip microphone that looked like a Hitler moustache, I climbed into the rear cockpit where the instructor sits when a student pilot is flying.

The bubble canopy was lowered and the turbine engine (Allison J-33-A-23) whined to a steady roar. I was glued to my seat as the plane sped down the runway, passed 100 miles per hour, and was off. The surprising thing was the absence of sensation as the fast ship, without propeller noise and exhaust sputtering, leaves most of its sound behind. Mainly there was the impression of rushing air, into the in-

takes, as in a typhoon on shipboard.

There was scarcely a bump . . . just a few quivers . . . as we passed tall cumulus clouds where updrafts boiled in the afternoon sun. We climbed to 10,000 feet in less time than it takes to tell. The altimeter spun faster than in fast sideslips in conventional planes.

Tony's voice came through the earphones, "Do you want to try an aileron roll?" "S-s-sure," I replied. The rate-of-climb pointed downward; we gained speed. The wing dipped and slowly we went over.

Misty blue sky, white clouds and green woods turned upside down till there was nothing but a film of plexiglas between me and the earth, two miles below. It was well to remember, in the instinctive urge to grip the sides of the cockpit, not to grasp the lever marked "Canopy Jettison." But the plane righted easily and we climbed for another roll.

Then a fast dive. "Not too many G's," I requested. "Roger," said Tony.

Down we sped against the roaring wind. Mist sprayed at my feet and condensed in droplets on the canopy. The altimeter spun windily. Louder rose the sound of rushing air. The airspeed indicator crept to 400 . . . 500 miles per hour . . . toward the green needle at the caution point, three-quarters of the speed of sound.

As we pulled out near the treetops, I knew that my body must weigh fully three times my normal weight but there was no great feeling of heaviness. With a G-suit, I could have taken 5 or 6 G's without great discomfort; wish now that I had tried it.

Skimming over the trees, at a sharp bank in a wide circle, we went over

(Continued on page 123)



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NAME _____

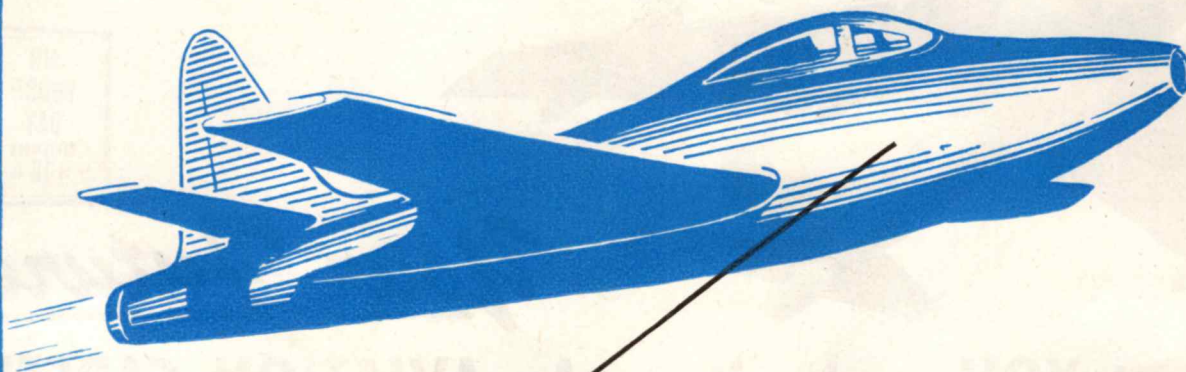
ADDRESS _____

CITY _____ AGE _____

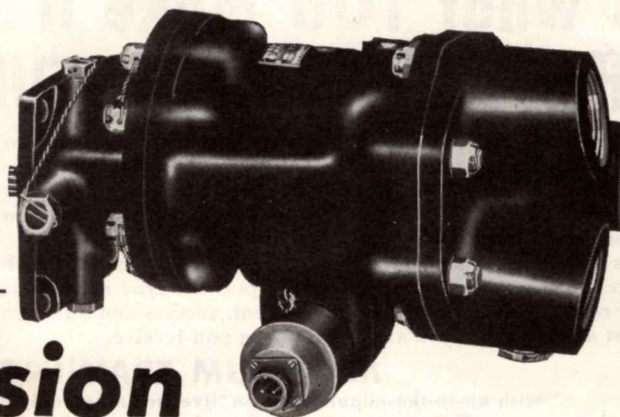
Check one: ☐ Veteran ☐ Non-Veteran

ZONE _____ STATE _____

AD-9



the "X" in jet propulsion



Of course, there is no letter "X" in the words "jet propulsion", but, in the development of jet engines, a very big and important "X" was the design of a fuel pump for this service. This was as tough a problem as any ever tackled by Pesco engineers, and here are a few of the reasons why . . .

1. The pump must deliver a barrel of gasoline in 1 1/4 minutes . . . three times the amount previously required.
2. It must pump that amount at as much as 750 lbs. per square inch pressure . . . 15 times the pressure used by American airplane engines during World War II.
3. It must have nearly the same service life as low pressure pumps. This was

the real sticker . . . since gasoline has no lubricating qualities, the wear of internal parts increased much more rapidly with higher pressures.

Pesco not only developed a high pressure fuel pump that met all requirements but went a step further in producing a pump with two pumping sections . . . one for the main fuel system and the other for the secondary system which goes into operation automatically . . . just in case.

The success of Pesco's solution to the "X" in jet propulsion is attested by the fact that today every American production jet engine uses a Pesco high pressure fuel pump.



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AIR DEFENSE TODAY

LIEUTENANT GENERAL GEORGE E. STRATEMEYER

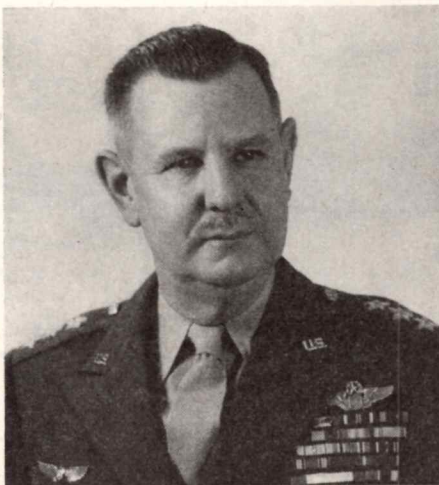
*Commanding General, Air Defense Command, Mitchel Air Force Base,
New York*

SHOULD the United States become involved in war again, the opening blow in all probability will be entirely unheralded. Future aggressors, fully cognizant of our nation's industrial production miracles in World War II, may well attempt to cripple our industry before it can enter into war production.

Air attacks, smashing against our heavily concentrated industries, quite possibly may be our first indication that we are once again engulfed in another full-scale war. To forestall such an eventuality, we need expertly-trained, well-equipped and adequate air defense forces capable of preventing, or at least largely nullifying, a surprise air attack of this type.

In the event our nation should be confronted with such an emergency, the agency entrusted with the heavy responsibility of air defense of the continental United States is the Air Defense Command, a four-air force, nationwide organization with headquarters at Mitchel Air Force Base, New York.

Embracing both Regular Air Force and civilian component units, the Air Defense Command, in event of a national emergency, would initially direct the coordinated air defense against enemy air attacks. In addition to its own Regular USAF units, the Air Defense Command would utilize the Air



Lt. Gen. G. E. Stratemeyer

National Guard and Strategic and Tactical Air Command specialized groups, which include all of the fighter and aircraft warning units and supporting services.

Strategic, Tactical and Air Defense Command elements, such as interceptor and escort groups, all-weather fighter and aircraft control and warning groups, are interchangeable and their training is being conducted along those lines.

Establishment of the Air Defense Command, in March, 1946, resulted partially from wartime experimentation with combat air power organiza-

tion during the Battle of Britain, and later in other war theaters. Experience gained from these campaigns established the precedent of creating command organizations for specific functions.

Capitalizing on this experience, birth of the comparatively new Air Defense Command came about a little over two years ago in conjunction with the major reorganization of the peacetime USAF.

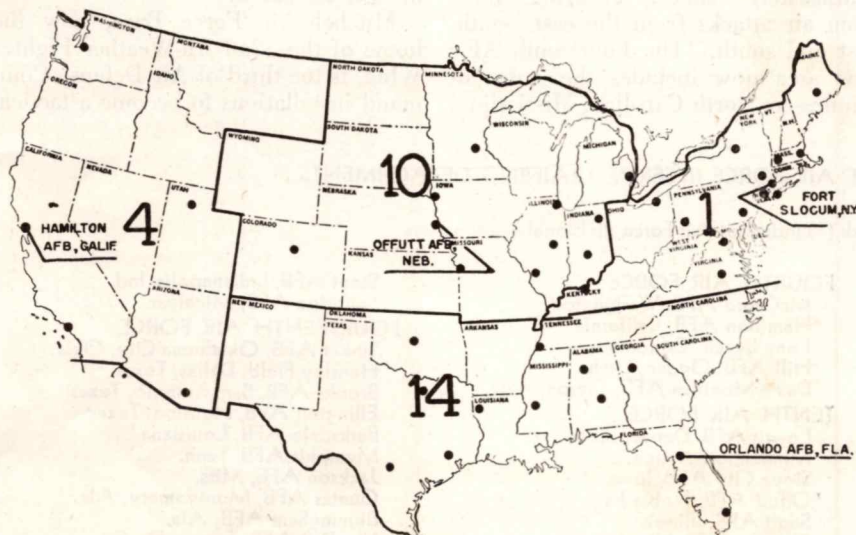
Originally, the Air Defense Command was organized into six air forces, the First, Second, Fourth, Tenth, Eleventh and Fourteenth Air Forces, which were dispersed throughout the country with control areas coterminous with Army areas. However, a study of air defense requirements, begun by ADC late in 1946, determined that an air force revision was necessary to increase efficiency and insure a more adequate defense organization. For best air defensive results, it was felt that each of the nation's four major areas should be placed under one air commander.

Reorganized in July

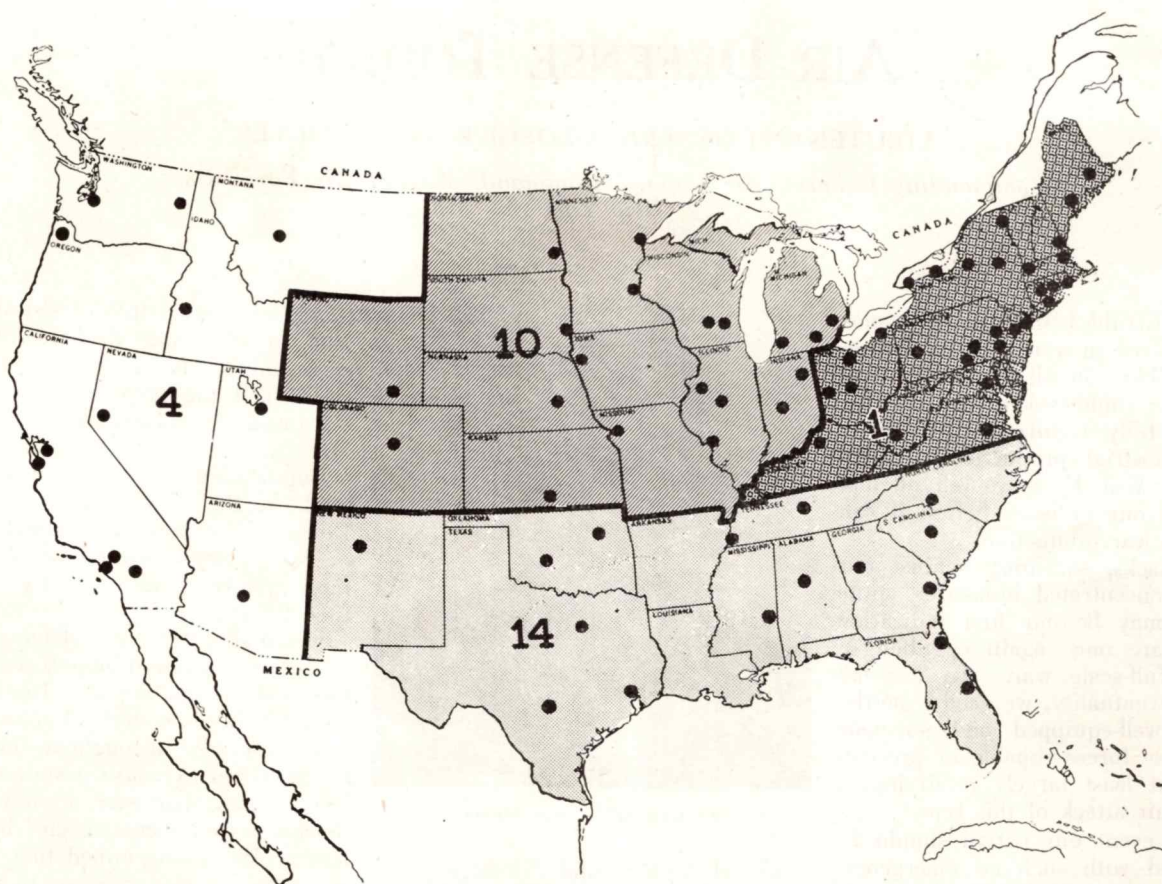
Consequently, the Air Defense Command underwent a reorganization last July 1, reducing its former six air force setup to four, which now include the First, Fourth, Tenth and Fourteenth Air Forces. Under the reorganization plan, the First Air Force absorbed the most of the area formerly comprising the Eleventh while the Fourteenth Air Force expanded to include the former Tenth Air Force zone.

Under the reorganization, the First Air Force, commanded by Major General Robert M. Webster, with headquarters at Fort Slocum (New Rochelle, N. Y.), will guard the critical target areas of the industrial northeast, including the states of Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Pennsylvania, Ohio, Maryland, West Virginia, Virginia, Kentucky and the District of Columbia.

Commanded by Major General John E. Upston, the Fourth Air Force, with headquarters at Hamilton Air Force Base (San Rafael, Calif.), will be responsible for the air defense of approaches to the west coast and vital



AIR DEFENSE COMMAND
Air Force Boundaries and Headquarters



AIR NATIONAL GUARD INSTALLATIONS
Plus 1 each in Hawaii and Puerto Rico

targets within the states of Washington, Oregon, California, Nevada, Montana, Idaho, Utah and Arizona.

The Tenth Air Force, now commanded by Major General Paul L. Williams, who formerly headed the deactivated Second Air Force, will establish its headquarters in the old Second Air Force's former site at Offutt Air Force Base (Fort Crook, Neb.), until such time as a new location in the middle-western area is selected.

Charged with the responsibility of safeguarding vital middlewestern areas against attacks from the north, north-

west, and west, the Tenth Air Force control area now includes the states of Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana and Michigan.

Finally, the Fourteenth Air Force, commanded by Brigadier General Ralph F. Stearley with headquarters at Orlando Air Force Base (Orlando, Fla.), will encompass the southern and southeastern states, covering them from air attacks from the east, southeast and south. The Fourteenth AF's new area now includes the states of Tennessee, North Carolina, Mississippi,

Alabama, Georgia, South Carolina, Florida, Arkansas, Louisiana, Oklahoma, New Mexico and Texas.

Air Defense Command headquarters will remain at Mitchel Air Force Base, New York. Mitchel Air Force Base, an administrative and flight-proficiency field for the past four years, is now a tactical installation. This change is in line with reorganization of certain USAF bases where combat aircraft are or will be based.

Mitchel Air Force Base, now the home of the 52nd All-Weather Fighter Wing, is the third of Air Defense Command installations to become a tactical

LOCATION OF AIR FORCE RESERVE TRAINING DETACHMENTS

Asterisk (*) indicates Air Force divisional headquarters

FIRST AIR FORCE

Dow AFB, Bangor, Maine
Bedford AFB, Bedford, Mass.
Westover AFB, Chicopee Falls, Mass.
Griffiss AFB, Rome, N. Y.
Stewart AFB, Newburgh, N. Y.
Mitchel AFB, Hempstead, N. Y.
Newark, New Jersey
Reading AFB, Reading, Pa.
Greater Pittsburgh Airport, Pa.
Andrews AFB, Camp Springs, Md.
Richmond, Virginia
Cleveland, Ohio
Godman AFB, Fort Knox, Ky.
*Fort Slocum, N. Y.

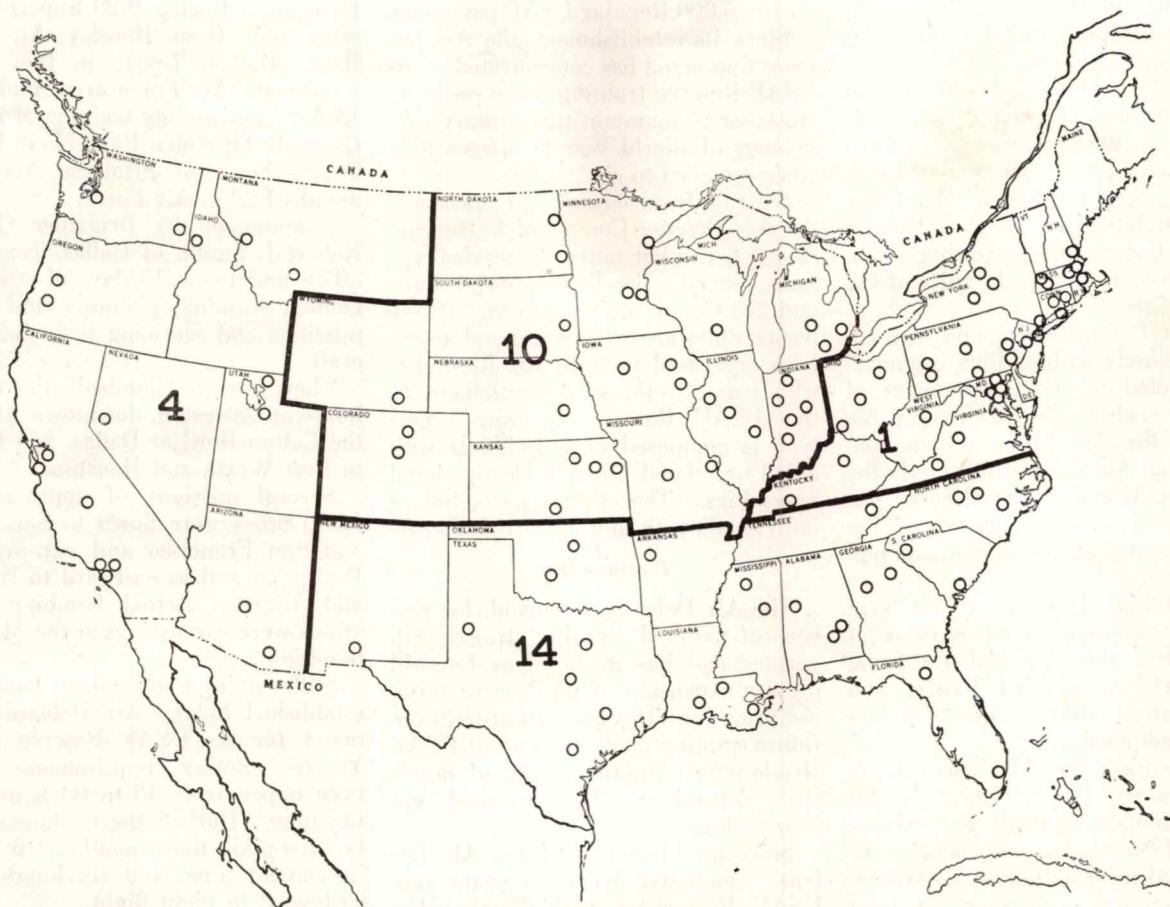
FOURTH AIR FORCE

McChord AFB, Washington
*Hamilton AFB, California
Long Beach, California
Hill AFB, Ogden, Utah
Davis-Monthan AFB, Tucson, Ariz.

TENTH AIR FORCE

Lowry AFB, Denver, Colo.
Minneapolis, Minn.
Sioux City AFB, Iowa
*Offutt AFB, Nebraska
Scott AFB, Illinois
Chanute AFB, Illinois
Orchard Airport, Chicago, Ill.
Fairfax AFB, Kansas
Baer AFB, Fort Wayne, Ind.

Stout AFB, Indianapolis, Ind.
Selfridge AFB, Michigan
FOURTEENTH AIR FORCE
Tinker AFB, Oklahoma City, Okla.
Hensley Field, Dallas, Texas
Brooks AFB, San Antonio, Texas
Ellington AFB, Houston, Texas
Barksdale AFB, Louisiana
Memphis AFB, Tenn.
Jackson AFB, Miss.
Gunter AFB, Montgomery, Ala.
Birmingham AFB, Ala.
MacDill AFB, Tampa, Fla.
Miami AFB, Fla.
Marietta AFB, Ga.
*Orlando AFB, Fla.



AIR R.O.T.C. COLLEGES & UNIVERSITIES

FIRST AIR FORCE

Trinity College
University of Conn.
Yale University
University of Kentucky
W. Kentucky State Teachers College
Johns Hopkins University
University of Maryland
Boston University
Harvard University
Mass. Institute of Technology
University of Mass.
Williams College
University of New Hampshire
Rutgers University
Colgate University
Cornell University
Fordham University

New York University
Syracuse University
Ohio State University
Ohio University
University of Akron
University of Cincinnati
Duquesne University
Gettysburg College
Lehigh University
Pennsylvania State College
University of Penn.
University of Pittsburgh
Virginia Military Institute
Virginia Polytechnic Institute
West Virginia University
Georgetown University
Howard University

New Mexico College of A&M
Oklahoma A & M
University of Oklahoma
Clemson Agricultural College
The Citadel
University of Tennessee
A & M College of Texas
Baylor University
Southern Methodist University
Texas Technological College
University of Texas

TENTH AIR FORCE

Iowa State College
State University of Iowa
Kansas State College
University of Kansas
University of Wichita
Washburn Municipal University
Michigan College of M & T
Michigan State College of A&AS
University of Michigan
Wayne University
College of St. Thomas
University of Minnesota
St. Louis University
University of Missouri
University of Nebraska
North Dakota Agricultural College
University of North Dakota
Colorado State College
University of Denver
Bradley University
Knox College
University of Illinois
Ball State Teachers College
Butler University
Indiana University
Purdue University
University of Notre Dame
Coe College
South Dakota State College
University of Wisconsin
Wisconsin State Teachers College
University of Wyoming

FOURTH AIR FORCE

Arizona State College
University of Arizona
Fresno State College
Loyola University of Los Angeles
San Jose State College
Stanford University
University of California at Los Angeles
University of Southern California
University of Idaho

Montana State College
Montana State University
University of Nevada
Oregon State College
University of Oregon
Utah State Agricultural College
University of Utah
State College of Washington
University of Washington

FOURTEENTH AIR FORCE

Alabama Polytechnic Institute
Tuskegee Institute
University of Alabama
University of Arkansas
University of Florida
University of Miami
Georgia School of Technology
University of Georgia

Louisiana State University
Tulane University
Southern Louisiana Institute
Mississippi State College
University of Mississippi
East Carolina State Teachers College
North Carolina State College
University of North Carolina

base. The other two are Dow Air Force Base, Maine, and Hamilton Air Force Base, California.

Although the primary mission of the Air Defense Command is the air defense of the continental United States, it also has a peacetime mission of training the United States Air Force Reserve and the Air Reserve Officers Training Corps and exercising training supervision of the air units of the National Guard.

The Air Defense Command also co-operates closely with civilian organizations devoted to the development of air power such as the Air Reserve Association, the Air Force Association, the National Air Council (formerly the Air Power League), the Reserve Officers Association, the American Legion, Veterans of Foreign Wars and similar groups.

In addition, because of its geographical coverage of all sections of the country, the Air Defense Command performs myriad liaison and administrative duties delegated by USAF headquarters.

For instance, the ADC provides a USAF contact, through its four Air Force commanders, with the various Army and Naval area commanders for exchange of information and coordination and action on matters of joint interest.

Among other diversified tasks, the ADC is responsible for organization, coordination and operation of the program for repatriation of the USAF's World War II dead. It participates in disaster relief with the American Red Cross, collects and maintains a filing system on current addresses of former World War II Air Force personnel, administers the USAF's home-study Extension Course program and operates two Port Liaison sections and three USAF Overseas Replacement Depots.

New Duties

Recently the Air Defense Command was assigned two additional missions involving new United States Air Force Provost Marshal Policies. The new missions call for the rehabilitation or retraining of USAF prisoners in the continental United States and the apprehension of approximately 4500 USAF personnel absent without official leave.

It is anticipated that the ADC's new prisoner-apprehension program will result in retrieving approximately 2300 men for USAF duties. Expectations are that the total number of absentees will be reduced by about 50% within six months after the program's establishment.

To perform all these myriad tasks, the Air Defense Command utilizes

about 25,000 Regular USAF personnel.

Since its establishment, the Air Defense Command has concentrated on its USAF Reserve training program in an endeavor to maintain the military proficiency of World War II airmen long since returned to civilian life.

Starting from scratch two years ago, the Air Defense Command has organized 264 combat units, 22 service-type units, seven miscellaneous-type units and 216 Composite squadrons. (Composite units are of two general types, both organized to train Air Reservists who cannot otherwise participate in the USAF Reserve program. One type is composed of individuals with allied or related Military Occupational Specialties. The other type embraces individuals with any MOS.)

Expansion

The Air Defense Command, for reasons of national security, strongly advocates and has made plans for still greater expansion of its Reserve training program. However, from 1949 on, future training plans must await USAF Headquarters approval and, of necessity, depend on Congressional appropriations.

Since establishment of the Air Defense Command over two years ago, USAF Reservists, as civilians using their own free time and receiving no pay, have flown over 810,000 pilot training hours. A total of 11,156 USAF Reservists have been given 15-day active-duty training tours this fiscal year. Pilots in this group flew over 112,000 hours while on these brief active duty tours.

At present 23 USAF Reserve Units are undergoing or have completed 15-day active duty training tours with other major commands. Strategic Air Command is training 12 USAF Reserve Very Heavy Bombardment units and the Tactical Air Command is training eight Troop Carrier units, two Light Bombardment Groups and one Reconnaissance unit.

In addition, commands other than the ADC will provide individual 15-day active duty training during the balance of this fiscal year for 1450 technically qualified USAF Reservists.

Unit training has long been a goal of the USAF Reserve training program. The past summer's unit training program, when 26 USAF Reserve units received 15-day active duty training, marked the first time in Air Force history that USAF Reserve officers and men were trained as a unit in peacetime. Formerly, USAF Reservists were called up individually for active duty training and fitted into various units scattered throughout the country.

USAF Reserve officers and men of the 309th Very Heavy Bombardment

Division, a Boeing B-29 Superfort Reserve unit from Hensley Air Force Base (Dallas, Tex.), in the ADC's Fourteenth Air Force area, undertook 15 days' active duty training at nearby Carswell Air Force Base (Fort Worth, Tex.)—home of Strategic Air Command's Eighth Air Force.

Commanded by Brigadier General Robert J. Smith, of Dallas, Texas, the 309th underwent 15 days of strenuous combat training, planning and flying missions and servicing their B-29 aircraft.

They camera "bombed" the roundhouse at Galveston, downtown Abilene, the Cotton Bowl at Dallas, and targets in Fort Worth and Houston.

Several missions of approximately 3,000 miles were flown to San Diego and San Francisco and out over the Pacific as well as eastward to Norfolk and Miami. Actual bombing operations were carried out at the Midland bombing range.

Stiffer flying requirements have been established by the Air Defense Command for its USAF Reserve pilots. Yearly piloting requirements have been upped from 48 to 60 hours' flying time. Half of the 60 hours must be first-pilot time, another 10 hours instrument time, and six hours must be logged in night flight.

Interchangeability

Cross training of USAF Reserve combat crew members is now being emphasized as a result of war experience which proved the desirability of crew members being trained and qualified to perform each other's jobs.

More realistic training is being offered the USAF Reservists by having them participate, whenever practicable, in actual maneuvers. For example USAF Reservists participated with Air National Guardsmen and Regular USAF personnel in joint Army, Navy and Air Force amphibious exercises, known as "Operation Seminole," held along the Gulf of Mexico and the Texas and Florida coasts last Fall. A similar exercise termed "Cactus," was conducted by the Tenth Air Force in conjunction with the Fourth Army.

Every opportunity is used to further the training of the USAF Reserve. Even while Reservists are being transported by air lift between their training bases and home-town airports, training and instruction is carried on.

During these routine hops the USAF Reservists are schooled in crew and radio procedures, receiving instruction in use of navigational aids such as driftmeter, radio compass and liaison radio equipment. They are briefed on parachute fitting, ditching, and bail-out procedures and are shown

(Continued on page 161)

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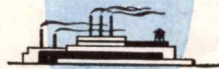
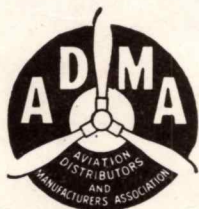
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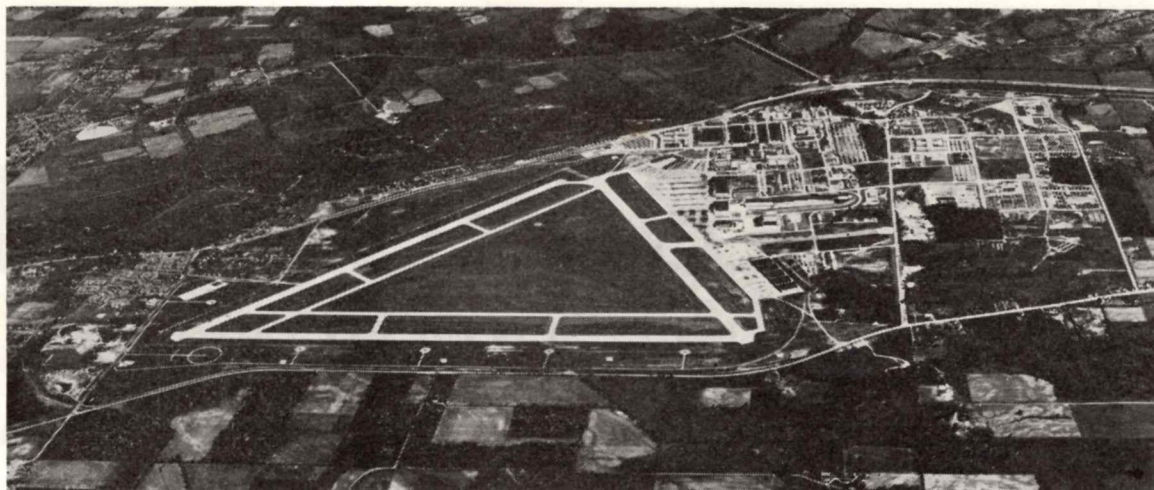
Eclipse-

Pioneer

DIVISION OF

TETERBORO, NEW JERSEY





Latest shot of Wright-Patterson Air Force Base, Dayton, Ohio, which the world remembers as "Wright Field"

NEW WEAPONS *for* AIR SUPREMACY

LIEUTENANT GENERAL B. W. CHIDLAW

Deputy Commanding General, Air Materiel Command

WHEN we look back to the time the Army bought its first airplane from the Wright Brothers in 1908, we find it astonishing that the contract requirement on speed was but 40 *mph*. The Wright plane in trial tests averaged 42 *mph*. From that day to this, the evolution of the airplane as a weapon of national defense has constantly increased in effectiveness to the point where it is now a pivotal weapon, and many studies of the present scientific world are associated with its improvement. First radio, then electronics, and now atomic energy have become fully involved with this once junior instrument of warfare.

The accomplishment and maintenance of supremacy in air power presents a continuous set of problems that emanate from our highly technological air age. The greater the technological advancement, the greater the need for organization. Most fulfilling needs in accomplishing the utmost for national defense are the coordination, cooperation, integration, and constant analysis of the relationship between science, industry, and the national military establishment. The National Security Act of 1947 has recognized the importance of building up our organization structures.

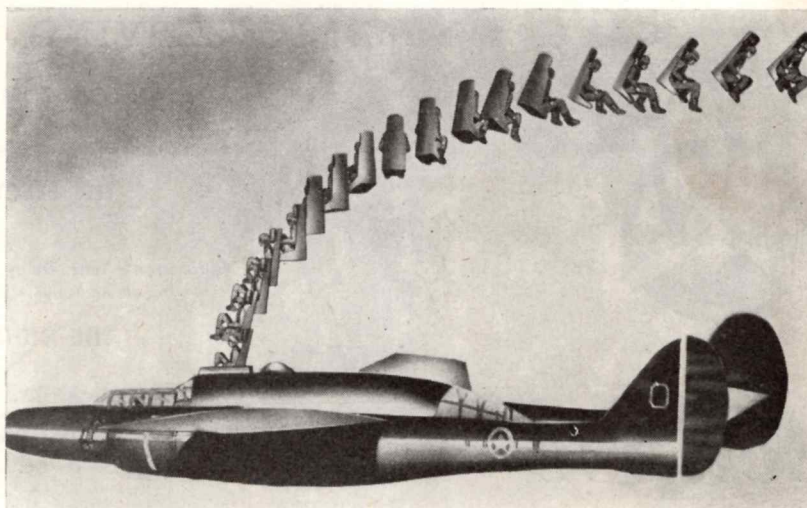
Under the National Military Establishment, the mission of the Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, is to develop aircraft and aeronautical equipment for Air Force use, to provide an

adequate and efficient system of procurement, supply and distribution for all Air Force material, and to organize and train units for accomplishment of this specific function. Flight and other training is the business of the Air Training Command.

The pattern of the AMC organization resembles that of Hq., Air Force since unification under the National Security Act. Under the Commanding General of the Air Materiel Command, General Joseph T. McNarney, there are three Directorates to accomplish the prime missions: Research and De-

velopment, Procurement and Industrial Mobilization Planning, and Supply and Maintenance.

Prior to World War II, the Materiel Center at Wright Field was engaged in a continuous program of research and development within the field of military aeronautics. During the war, the demands for huge production brought the supply and maintenance program into particular prominence, although at no time was an aggressive research-and-development program permitted to slacken. The present post-war interim program is divided



AMC experiments resulted in the pilot-ejector seat, which provides an escape from high-speed planes in case of trouble. Diagram shows how pilot and seat are shot clear of the plane so that a routine parachute descent can be made. At right is the installation in an F-80B

equally. The three Directorates parallel the three prime missions of the AMC in the search for better equipment, in the preservation of close contact with industry, and in the furnishing of supplies and maintenance to all USAF units.

The recently established Research and Development Board within the new National Military Establishment is charged with the responsibility for planning and guiding of the Government's over-all development programs. Through its several technical committees and subcommittees, the Board coordinates the aeronautical programs of the Air Force, Navy, and other agencies with activities in other related scientific fields. The work done in research and development by the Air Force is conducted by the Air Materiel Command through its Directorate, Research and Development.

The responsibility for accomplishing the mission of Directorate, Research and Development is shared by the Engineering Division, Flight Test Division, and the All-Weather Flying Division located at Wilmington, Ohio. In conjunction with Headquarters, USAF, long-range plans are formulated which cover research and development in the fields of: piloted and pilotless aircraft; electronics; sub-sonic, trans-sonic and supersonic aerodynamics; aircraft armament; powerplant; rocket, jet and nuclear energy propulsion; aviation medicine and psychology; meteorology; upper air research and all-weather flying.

The Engineering Division draws on the National Advisory Committee for Aeronautics, an independent Federal agency, for fundamental basic research in aeronautics, and it, in turn, explores



Lt. Gen. B. W. Chidlaw

and evaluates military application of aircraft and equipment. From time to time universities and engineering schools are awarded aeronautical research projects under Government contract. The results have been excellent. The laboratories of aircraft manufacturing companies are generally operated for the improvement of particular products, but their findings contribute more than a little to the generally available pool of information.

Field Experiments

Because Wright-Patterson Air Force Base has its limitations as to geographical location, size, climatic conditions, and other factors, it has been found necessary to establish outlying installations for adequate experimental testing. Engineering and development installations under technical control of Engineering Division, Hq., AMC are: Muroc Air Force Base, Muroc, Calif.; Holloman Air Force Base, Alamogordo, New Mex.; and Kirtland Air Force Base, Albuquerque, New Mex.

At Muroc Air Force Base, the terrain is basically a dry lake bed which affords a five- or six-mile runway in every direction. It is an ideal spot for testing experimental aircraft with greater safety than from conventional airdromes in thickly populated areas. It was here that the Air Force research plane X-1 was several times flown faster than the speed of sound.

The wild, open terrain at Alamogordo, New Mex., permits the testing of pilotless aircraft, guided missiles, and allied equipment with comparative safety.

At Ladd Field, Alaska, we have a testing detachment of the Engineering Division which is concerned with the winterization testing of all of our

items of equipment, from the complete airplane down to the components and items of ground equipment which must stand up if our Air Forces are going to operate properly under conditions of winter weather.

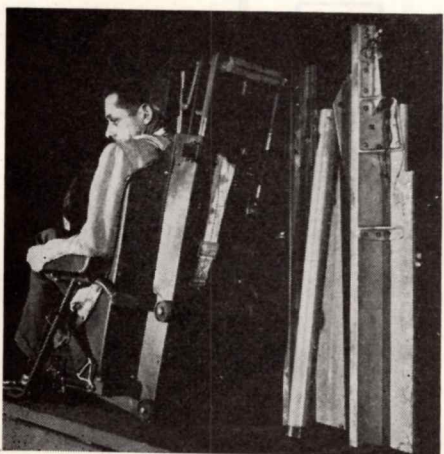
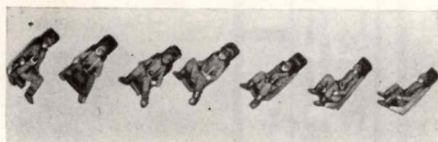
In the science of electronics, there are at least three very important phases of current aeronautical development which involve extensive use of complicated electronic devices—the detection of the approach of enemy aircraft or missiles, the guidance of our own missiles and pilotless aircraft to targets, and the navigational and blind-landing requirements of all aircraft. The Air Force electronics facilities consist chiefly of the Electronics Subdivision at Wright-Patterson Air Force Base; the Watson Laboratories at Red Bank, N. J.; the Cambridge Field Station at Cambridge, Mass.; and the Flight Research Units at Rome, N. Y., and at Warner Robbins, Ga.

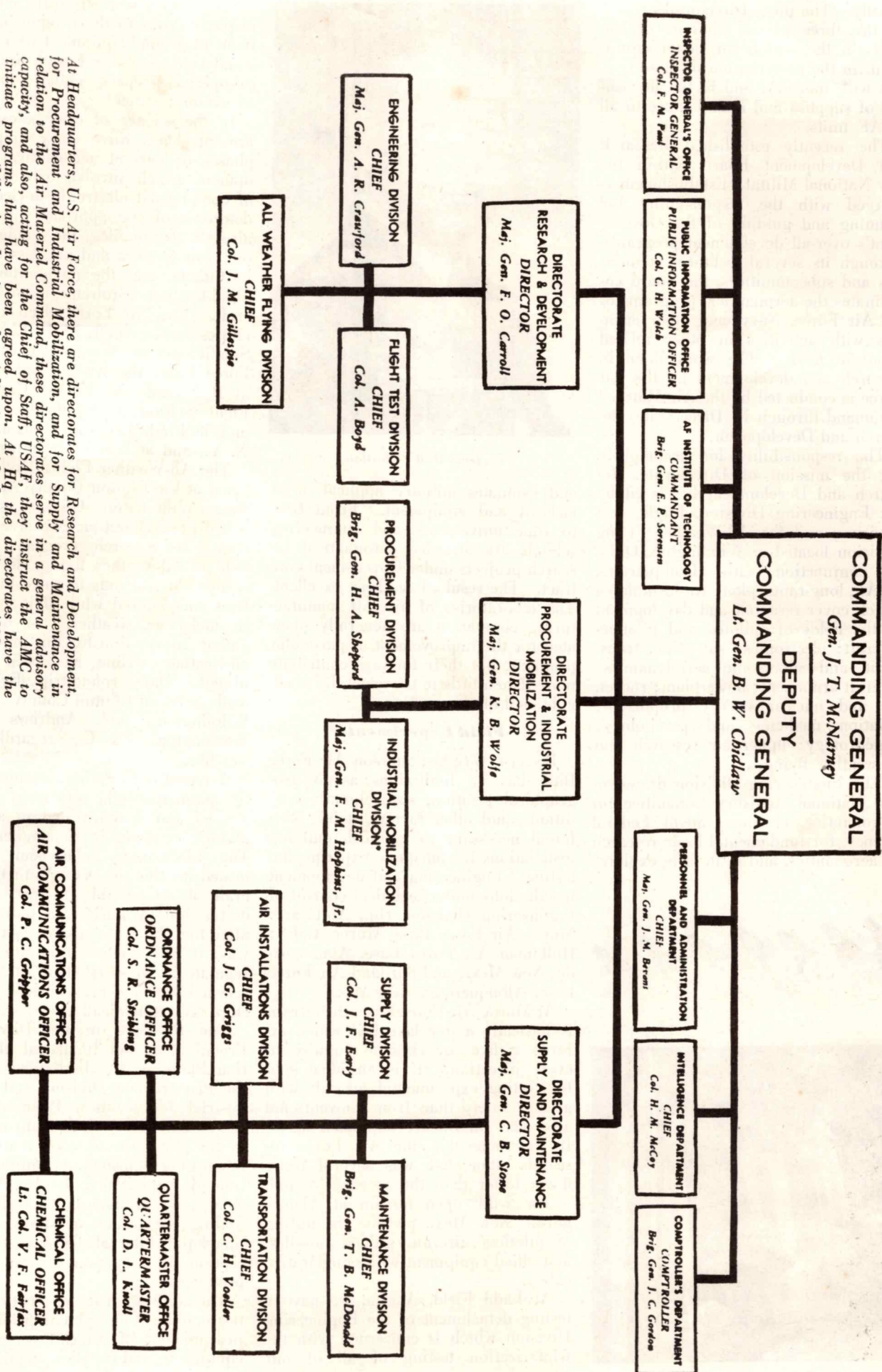
The All-Weather Flying Division located at the Clinton County Air Force Base, Wilmington, Ohio, was established to carry out an extensive experimental-and-research program in the field of all-weather flying, developing equipment and aids to solve the problems encountered while flying aircraft in inclement weather. In order to gather information for this project, an all-weather airline has been inaugurated. Daily round-trip flights are made between Clinton County Airport, Wilmington, and Andrews Field, Washington, D. C., regardless of weather.

A recent outstanding development is the automatic-flight equipment used on a C-54 and demonstrated in a transatlantic crossing in September 1947. The Electronics Subdivision collaborated on this project. With this aircraft it is possible to pre-select a destination by pushing a button and, after the plane has taxied on the runway, it will take-off, raise its wheels, regulate its airspeed, land at the pre-selected site, and brake itself to a safe stop, all automatically.

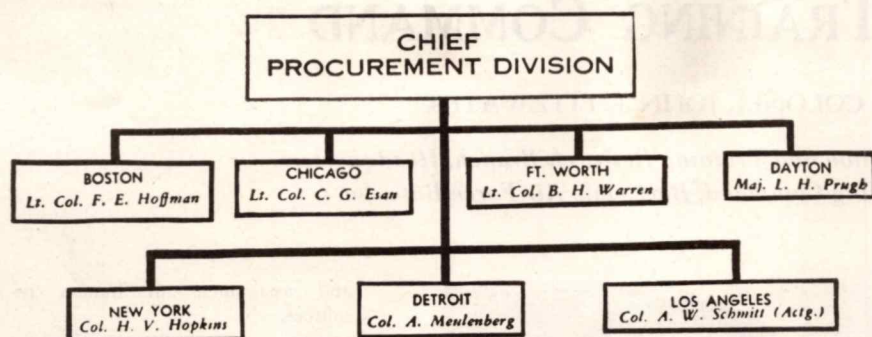
The functions of the Directorate, Procurement and Industrial Mobilization Planning are discharged through the Procurement Division and the Industrial Mobilization Planning Division. This dual relationship is a step in the direction of coordinating and integrating industry and military aviation by emphasizing the possibility of emergency production as well as by finding the means of shortening the time-lapse interval between the conception of a weapon of war and its production.

The addition of the element of industrial-mobilization planning into the procurement of aircraft, spare parts, equipment, and supplies peculiar to the





At Headquarters, U.S. Air Force, there are directorates for Research and Development, for Procurement and Industrial Mobilization, and for Supply and Maintenance in relation to the Air Materiel Command, these directorates serve in a general advisory capacity, and also, acting for the Chief of Staff, USAF, they instruct the AMC to initiate programs that have been agreed upon. At Hq, the directorates have the responsibility for planning and coordination, with the execution at AMC



AIR MATERIEL COMMAND

District procurement offices are well scattered throughout the U.S.

Air Force, guarantees that attention will be given to the design features of major aeronautical items and to the ability of interested manufacturers to mass-produce the items when and if required to do so. Studies will be made of the ability of each of the bidding manufacturers to produce not only at the proposed peacetime delivery rate, but also at a specified mobilization rate in the event of an emergency during the life of the contract.

Items of materiel bought by AMC for development or service use of the Air Force are chiefly classified into experimental and standard types. The experimental type is an item being developed which has not progressed to the stage where engineering and service tests indicate that the item is sufficiently satisfactory to warrant standardization. The standard type is materiel which has been adopted for use by the Air Force, and is the most advanced, satisfactory, and preferred for procurement. It is through the medium of the written contract that the Air Force establishes its procurement relationship with industry.

In medium-bomber aircraft, the Boeing B-50A, successor to the B-29 Superfortress of World War II fame, is an example of the standard type, although it is still in the early production stage. The Consolidated Vultee XB-46, the Boeing XB-47, and the Martin XB-48 are experimental light bombers. Only one XB-46 and two each of the XB-47 and XB-48 have been procured.

The duties discharged under the Directorate, Supply and Maintenance are divided among four divisions—Supply, Maintenance, Air Installations, and Transportation. The Directorate of Supply and Maintenance is responsible for setting up and exercising control over an elaborate system to supply and maintain Air Force Units throughout the U. S. as well as in overseas theatres.

Within the continental limits of the

United States, there are seven Air Materiel Areas, with headquarters at Sacramento, Calif.; Ogden, Utah; San Antonio, Tex.; Oklahoma City, Okla.; Mobile, Ala.; Warner Robbins, Ga.; and Middletown, Pa. These areas are the arms of the Air Materiel Command and are basically concerned with supply and maintenance support of the Air Force units established within the geographical boundaries of their respective areas.

In the case of supplies and maintenance for aircraft already in existence, the determination of requirements is based on the inventory records, which reveal the on-hand, on-order and previous experience of the expenditure. This gives a very close control over the quantities necessary to keep operating those models presently in the hands of the tactical command.

New-Make Tests

When a new-model aircraft is purchased, plans are immediately initiated to fulfill the supply and maintenance needs to coincide with its operational debut with Air Force units. In the case of the purchase of Boeing B-50's, the Directorate, Supply and Maintenance began planning—as soon as the contract was signed with the Boeing Airplane Co.—to supply and maintain this aircraft in the field.

The determination of supply requirements and performing the operating functions of receipt, shipment, storage, preservation, issue, and stock control of USAF materiel, makes a maintenance program inevitable. It is USAF policy that the base or using activity will maintain repair facilities for minor repairs and replacement of major unit assemblies, which are classified as organizational and field maintenance. Depot Maintenance, consisting of major repairs, is the responsibility of the Air Materiel Command. It is the mission of the AMC maintenance program to perform maintenance repair and restoration service beyond the

capabilities of the base or using organization.

Included in this program are overhaul, modification of aircraft, aircraft equipment, aircraft accessories, vehicles, and field communication systems, etc. In addition to the training of maintenance personnel, the program includes the furnishing of necessary technical information and instructions



*The three buying divisions of
AMC, Procurement Division*

affecting maintenance and supply procedures and operations.

The Air Materiel Command is charged with currently supplying and maintaining the materiel peculiar to one department of the Armed Services—the United States Air Force. The pitfalls of a highly complicated technological age may be avoided if we have a great deal of cooperation and integration of science, industry, and the National Military Establishment.

The lessons of World War II constantly remind us to build up our organization structures. Research and Development and Industrial Mobilization Planning have been undergoing critical analysis in order to bring about improvement. The goal is assurance that our Research and Development and Industrial Mobilization Planning are adequate to supply superior material and support to the United States Air Force.

Selling to USAF

CONTRARY to general opinion, U. S. Air Force buying is not done from one office in one locality. It is carried on from hundreds, literally hundreds, of offices and some of the orders originate in every locality where the Air Force is operating. It is a vast and complex system. There are many variations.

Procurement stems from 3 main sources; (1) Directives from Headquarters, (2) Supply orders based on approved programs, and (3) Requisitions from the field.

In general, the contracts for supplies and
(Continued on page 126)

AIR TRAINING COMMAND

COLONEL JOHN T. FITZWATER

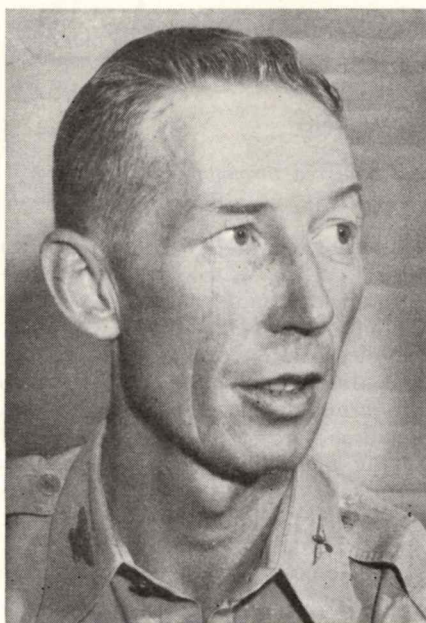
*Chief of Education and Training Research Branch, Headquarters,
Air Training Command, Barksdale Air Force Base, La.*

THE Air Training Command is formally charged with the mission of conducting individual training of Air Force airmen and officer personnel. Since training in the broad sense is the focal point of most personnel problems and since it interacts with materiel problems, the activities and operating interests of the Air Training Command are closely connected with the two fundamental Air Force Services, Materiel and Personnel.

The training operations extend considerably beyond the administration of formal schools for the training of individuals, as distinguished from units and organizations. It is the function of the Air Training Command to accommodate the entire Air Force with regard to the major portion of personnel service requirements. Understanding of Air Training Command functions will, therefore, be facilitated by thinking in terms of a Personnel Service Command rather than of a training institution alone.

Personnel problems have rapidly become the most critical in the modern Air Force. Scientific advancements in materiel which increase destructive power per man have operated, through air potentialities, to increase the scope and extent of warfare rather than to decrease manpower requirements. Thus quantitative training requirements are increased. Qualitative requirements, or training levels, are likewise greatly increased by technical complexity of equipment, while time for mobilization or achieving personnel requirements in an emergency is drastically reduced. These conditions dictate greater concern than ever before for efficiency in manpower allocation, training, and utilization.

At the beginning of World War II, schools of the Air Force were producing graduates at the rate of about 100,000 per year. It was not until mid-1943, a year and a half later, that the peak production of 1,416,000 graduates per year, required to support the combat units, was achieved. Those contemplating the significance of these statistics, must remember that Air Force mobilization actually began in 1939. To achieve this gigantic task the Training Command had to make sacrifices, in many instances great sac-



Col. John T. Fitzwater

rifices, of pre-war renowned high quality.

Two facts stand out in the experience of mobilization of human resources for the Air Force in the last war. First, the time required was too long, and, second, the waste was too great in spite of the fact that an extensive personnel research and development program was gotten under way with primary emphasis on selection and assignment of students to training according to highest aptitude. The results of this program were not realized until relatively late in the war. They effected great savings of training capacity; but it should be realized that the procedure of assigning men according to their greatest aptitudes may be a luxury which can be ill afforded in a total mobilization. The objective, then, must be the most effective distribution of total human resources according to total requirements.

If the factors contributing to reduction of personnel requirements are properly controlled to affect a minimum, adequate air protection can be a reality only if one, several, or all of the following obtain, depending upon treatment of the first:

- a. A large standing Air Force.
- b. Pre-mobilization training in technical specialities.
- c. Maximum efficiency in allocation

and assignment of human resources.

d. Maximum efficiency in training.

The Air Training Command is most directly and vitally concerned, in its operation and planning, with the last two of these. Today's activities and plans must always develop in terms of the solution of M-Day problems.

Now, not M-Day, is the time for collecting the data and doing the experimenting necessary for the possible obviation and solution of these problems. Thus, the primary emphasis in the Air Training Command is on research-and-development activities in the field of Human Resources. This program is now in the initial stage of reestablishment and is broadening in scope after the demobilization "blitz" which almost denuded the ranks of its personnel. This work will go on under the guidance and advice of an Advisory Board composed of the most competent Psychologists, Educators, and other scientific personnel available as consultants from civilian life.

The cooperation and assistance of other Government agencies, such as the United States Office of Education and civilian research organizations, will be utilized where advantageous. All manner of basic and applied research and development in the field of Human Resources necessary to the best solution of Air Force problems in qualification, selection, training, and utilization of manpower will come under investigation.

Organization

Lieutenant General John K. Cannon commands the Air Training Command with headquarters at Barksdale Air Force Base, Louisiana. School and station operations are controlled by three Divisional Commands. All flying training is centered in the Flying Division, Air Training Command, under the command of Major General James P. Hodges, with headquarters at Randolph Air Force Base, Texas. All training for ground technical specialties is conducted by the Technical Division, Air Training Command, under the command of Major General C. C. Chauncey, with headquarters at Scott Air Force Base, Illinois.

The Indoctrination Division, Air

Training Command, commanded by Major General Robert W. Douglass, Jr., with headquarters at Lackland Air Force Base, Texas, provides basic military training for all airmen without prior service, classifies them for duty, and selects them for training at technical schools. The Air Force Officer Candidate School is also operated by the Indoctrination Division.

The Flying Division operates six basically different curriculums in producing the pilots and bombardment specialists necessary to man and sustain tactical Air Force units. The Division has two major responsibilities—to train and produce officers of the highest quality, and to develop them into the most technically proficient military fliers in the world.

This training is of two types—undergraduate and postgraduate. Undergraduate training is the development of basic flying skills leading to an initial aeronautical rating. Postgraduate training develops specialized skills for already-rated personnel.

Aviation Cadets

The Aviation Cadet pilot-training program is the only undergraduate flying course conducted at this time. The course is 52 weeks in length and is divided into a basic phase, eight months in length, and a four-month advanced phase for the development of single-engine or multi-engine specialization. From the very beginning of this program, maximum emphasis is upon the development of the moral responsibilities, courtesies, and customs of Air Force officers. These elements, augmented by intensified military training, are continued throughout the program, molding the trainee to

the high standard demanded of Air Force officers.

Flying instruction is conducted in the T-6 aircraft. The student is taught to fly under contact conditions and is then introduced to instrument flying, navigation and other advanced techniques.

After successfully completing the basic phase, the student is selected, on the basis of his individual desire and the recommendation of his supervisors, for the specialized advanced course. In the advanced single-engine phase, the student develops his proficiency in the F-51 *Mustang*, with emphasis upon formation, navigation, and instrument flying as related to fighter-type aircraft. A portion of students in this phase, earmarked for assignment to jet-fighter units upon graduation, receive training in the jet-propelled F-80 *Shooting Star* before completion of their training. Advanced multi-engine trainees fly the B-25 *Mitchell* Bomber, developing skills predicated directly upon bombardment-type aircraft.



Pilot trainees slated for jet fighter units learn formation flying in F-80's

Basic-phase training is conducted at this time at Randolph Air Force Base, Texas, Goodfellow Air Force Base, Texas, and at Perrin Air Force Base, Arizona, with advanced multi-engine training at Barksdale Air Force Base, Louisiana.

This program is currently in process of expansion to a 3,000-pilot per year production rate. This will of course necessitate establishment of additional training centers. Perrin Air Force Base, for example, did not go into operation until July 1 of this year, and other bases will be reactivated as the expansion progresses.

Of the postgraduate courses, the bombardment training program is the most complicated and compact. This program, conducted at Mather Air Force Base, California, integrates the skills of the navigator, bombardier, and radar observer into one aircrew position. Only rated navigators and bombardiers are being accepted in this program at this time; they are assigned to schooling on temporary-duty status from operational Air Force units. Thirty weeks are required for the training of rated navigators, while thirty-seven weeks are required for the training of rated bombardiers to the additional skills required.

In order to develop the Air Force for all-weather operations, the Flying Division conducts the Air Force Instrument Pilot School at Barksdale Air Force Base as a postgraduate course for rated pilot officers. The mission of this school is the standardization of instrument-flying procedures and tech-

(Continued on page 135)



USAF photos

An instructor at Randolph Air Force base, Texas, gives his Aviation Cadet pilot students flight tips in the North American T-6, formerly an advanced trainer, but now the first airplane they learn to fly

SOME FUNDAMENTALS OF STRATEGIC THINKING

ORVIL A. ANDERSON

Major General, USAF, Commandant, Air War College

PROGRESS in any human activity is achieved through a combination of experience and imagination. An understanding and proper evaluation of past experience provides a springboard for the projected thinking, the imagination, the inventiveness, which generates a new solution to a new problem—which changes the patterns and procedures of the past to accommodate the new and different factors bearing on the current and future situations.

The conduct of wars is no exception to this observation. Progress in the development of military science and strategy is vitally dependent upon the soundness of the evaluations of past battle experience and upon the boldness, inspiration and depth of the projected thinking which creates the solution for the future.

To arrive at an inaccurate or superficial evaluation of past war experience is to establish an unrealistic point of departure for projected thinking; and to be timid, irresolute, and uninspired in forward thinking is to cling to the real or fancied patterns of the past. Both of these evils profoundly affected the course of World War II, and both are having a continuing impact on the design of our military structure for the future.

A change of revolutionary magnitude has taken place in the basic nature of war, and the patterns of the past provide only limited guidance to planning for the future. The power of modern weapons demands that this revolutionary change be recognized and properly evaluated; there may be no time, in a possible future war, for the type of belated, drastic and costly improvisation which was so characteristic of the conduct of World War II.

In order that this revolutionary change may be grasped, in order that accurate evaluations of past experience may be made, and in order that sound projection may be accomplished, it is essential that military planners have a comprehension of certain factors having fundamental significance. These factors may be stated as follows:

First, an understanding of the basic nature of war.

Second, a comprehension of the decisive categories of military action and their inter-relationship.

Third, a grasp of the military potential of technological development.



Maj. Gen. O. A. Anderson

And fourth, an adequate knowledge of the economic and military character of the probable enemy.

The Nature of War: An appraisal of past experience is a logical point of departure in attacking any new problem, and past battle experience cannot be competently evaluated without an understanding of the basic nature of war. An analysis of war indicates that there are three characteristic military phases involved, namely:

The build-up phase.

The decisive phase.

The exploitation phase.

No exact line may be drawn between these phases, as one blends into the next, and there may be some variation by area in the timing of the decisive action or exploitation action in a global war. However, both wars and major campaigns, logically, do follow this pattern.

During the *build-up phase*, the nation is creating the major military forces which it will use. Men are being trained, the machines of war are being built, and the logistics are being provided. In addition, minimum military forces may be committed for the accomplishment of vital tasks or undertakings essential to future operations. During World Wars I and II, our build-up phase occurred, substan-

tially, after armed hostilities were under way. The build-up phase for a third World War, in all probability, cannot take place after armed conflict is joined. During the build-up phase for World War II, fighting by those minimum forces committed to vital tasks was an uphill proposition. The odds were even at best, and evaluations of the battle performance of weapons based on the experience of this period normally are valid.

During the *decisive phase* of war, the major military forces which have been created are employed, and one belligerent is mortally wounded. Formal surrender, in the classic sense, may not yet have been tendered, but, from the standpoint of national capability to rebuild or employ a force capable of decisive action, one of the belligerents has been defeated. From the decisive phase of World War II, during which time the major and predominant elements of opposing military forces were in collision, reliable evaluations of weapons and techniques may also be drawn. During this phase, enemy opposition was the best of which he was capable. A true test of weapons, therefore, may have resulted.

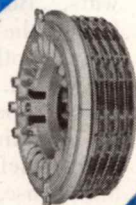
Mopping Up

During the *exploitation phase* of war, mopping-up operations are conducted. Exploitation operations may be accomplished by land, sea, or air weapons or by a combination. Much fighting may continue and a great amount of destruction may be involved—how much depending on the suicidal determination of the defeated force and on the victor's exploitation strategy. In this connection, it is interesting to observe that more than 80% of the physical damage inflicted upon Germany and Japan occurred during this phase of the war. Both German and Japanese leadership failed to recognize the basic nature of modern war—failed to recognize the decisive nature of the air battles which preceded the exploitation phase of the conflict. Accordingly, long after their military positions were hopeless, they subjected their populations and industry to a vast amount of unnecessary destruction.

During the exploitation phase of the war, the victor nation may always be assured of a preponderance of strength. It is opposing the constantly declining

Bendix Products

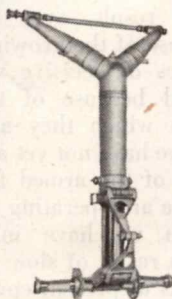
BUILDERS OF BASICALLY BETTER LANDING GEAR EQUIPMENT



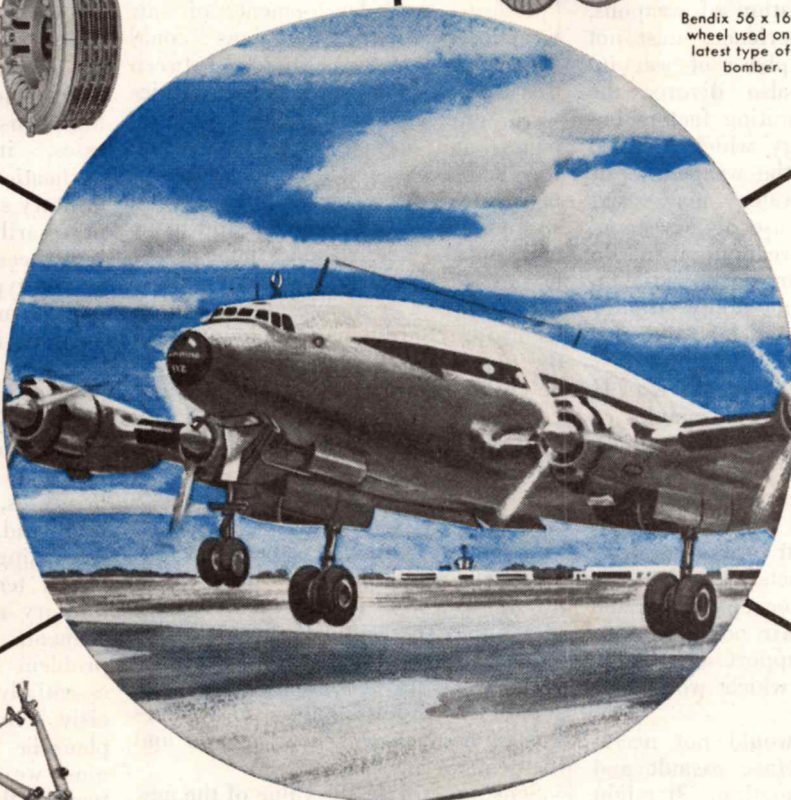
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strength of the enemy's military power, and from this phase of war many inaccurate and superficial evaluations of weapons and techniques can be drawn.

Obviously, a victor nation may assign any capability it desires to its weapons and techniques. All it need do, is select the time and the place favorable to the evaluation. Such evaluations, patently, can be disastrous to future national security. These mistakes, however, will not be made if the phase of the war involved be clearly seen, if there be a strong, conscious, and deliberate effort by military evaluators to measure enemy opposition in specific terms, relating cause and effect, and to favor the long-range welfare of the nation, rather than the short-range welfare of any one service.

Evaluation of Weapons

A scientific evaluation of weapons, based on battle experience, must not only recognize the phase of war involved, but must also divorce the weapon from any limiting factors imposed by the strategy which dictated the employment of the weapon. For example, a faulty strategy may result in an inappropriate use of a weapon. To measure that weapon, then, in terms of its demonstrated potential in the furtherance of that faulty strategy may be to miss completely the real value of the weapon.

Many evaluations of World War II air power provide classic examples of this mistake. World War II, in both major theatres, was fought in consonance with a surface strategy—not an air strategy. By surface strategy, it is meant that our grand strategy visualized a final decisive surface assault, invasion, and occupation of the enemy homeland. Air power was to be employed as a support weapon, as an ancillary force, which would expedite the invasion.

An air strategy would not necessarily involve a surface assault and two-dimensional occupation. It might visualize the destruction of enemy national logistical potential, and continued air surveillance until the remnants of the population were reduced to total military impotence or until they had tendered the classic formal surrender which is still deeply, and unrealistically, rooted in national thinking. However, World War II was not fought to an Air strategy, and to evaluate the air weapon, in terms of its contribution to a surface strategy, is to invalidate the entire evaluation.

And finally, even though the appropriate phase of war be recognized, and even though battle experience be competently evaluated, it is mandatory

that we recognize that these demonstrated values of weapons are highly transient in this technological age and are applicable only to specific times, situations and objectives. The established values of the past must be translated—extrapolated for the future—in a manner consistent with the evolutionary nature of technology and warfare and consistent with geopolitical relationships.

Categories of Military Action: Concurrently with a sound evaluation of past battle experience, we must understand the categories of decisive military action and their relationship. Prior to World War II, decisive military action occurred either on the land or on the sea. A third category of decisive action emerged from World War II, a decisive action in the air—and decisive air action was found to be a prerequisite to "decisive" land or sea action.

Before the development of air weapons, military functions could somewhat logically be divided between the land and the sea. Land armies were employed for decisive land campaigns and occupation purposes; sea forces were designed to destroy opposing sea power, impose blockade and strangulation on the enemy, and move and supply friendly land armies across bodies of water as required. However, there was a minimum requirement for coordinated employment of the two types of forces. One was inherently chained to the sea for decisive operations, and the other was inherently chained to the land for decisive operations.

The Disturbing Airplane

However, with the advent of the airplane, operations in the medium of air introduced a new and unbalancing factor into the conduct of wars. The air was common to both the land and the sea and no barriers existed at the shoreline. Additionally, no barriers existed between this new weapon and the heart of any nation.

Sensing, at first, the value of the new device for reconnaissance purposes, both land and sea forces began utilization of the airplane in a limited role, and both expanded that role as time passed and the power of the weapon became greater. With the adoption of the airplane, the Army and Navy started losing their individuality with respect to their basic weapons. Each service became progressively more dependent upon air weapons.

An evolutionary process had been started which, ultimately—as technology increased the range, speed and destructive power of air weapons—would result in the same basic weapons as the prime destroyer, as the back-

bone or nucleus, of each of the two forces. With this loss of individuality in the primary weapons of war, the Army and Navy were participating in a common medium of operations. Such a common medium demanded an integrated military effort—a unification of all elements in the military structure into a mutually supporting, inter-acting, appropriately balanced team of air, land, and sea components.

But appropriate balance is not achieved by the maintenance of three equal forces, each designed to be decisive. It can be achieved only by a composite military structure designed to support an objective strategy, reflecting the dominant role of Air Power and the supporting roles of land and sea forces. No longer can armies and navies fight more or less independent wars. Both are dependent upon control of the air for successful operation—and both are vulnerable to enemy air action. Neither can conduct "decisive" operations until truly decisive air operations have been completed.

In brief, air power, in the long-term sense, through evolutionary processes, inevitably will force true unification of all the components of the military structure. Such unification will necessarily result, over a period of time, because of the growing similarity in the types of decisive weapons employed and because of the common medium in which they are operated.

Today, we have not yet achieved true unification of the armed forces of the nation. We are operating with a structure which we have inherited and which, as a result of slow evolutionary processes, is at present compartmented into land, sea and air organizations. Accordingly, each of these components has a tendency to plan for decisive military action indigenous to its own element. Therefore, one of our major problems in planning future strategy, essentially, is this: For how many "decisive" categories of action should plans be made? Will one suffice, or must we plan and build and pay for two or three "decisive" categories of action? If one category is, in truth, "decisive," does logic support the creation of decisive capabilities in the other two categories?

There can be no real doubt remaining as to which category of action is truly decisive. In his final World War II report to the Combined Chiefs of Staff, General Eisenhower stated:

"... The overwhelming Allied superiority in the air was indeed essential to our victory. It at once undermined the basis of the enemy's strength and enabled us to prepare and execute our own ground operations in complete security."

(Continued on page 142)

CIVILIAN COMPONENTS *of the* AIR FORCE

If our flying minute men were called today, it would be a long minute before they went into action. They are willing but, through no fault of theirs, unready

KENDALL K. HOYT

BACKING the Air Force in peacetime by volunteer effort and pledged to military service or home-front duties in war are the so-called civilian components—the Air Force Reserve, Air National Guard, Air ROTC, Civil Air Patrol and satellite associations.

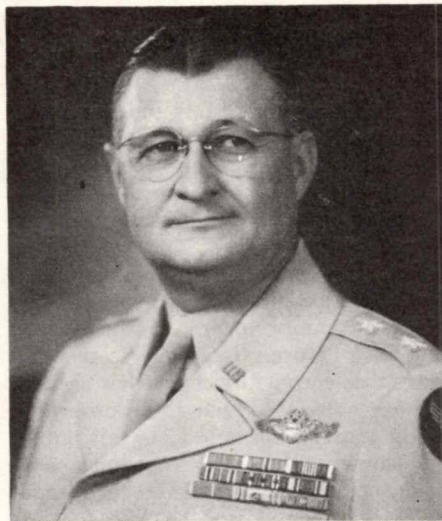
Because the regular Air Force must be expanded several times its present strength in emergency and because immediate striking power is of greater moment than ever before, the readiness of these organizations is vital to our security. They are not, however, nearly prepared for that day . . . too soon perhaps . . . when the bell may ring on a General's desk and a voice will say, "This is it."

What do we do when the bell rings? Too many of our primary and secondary reserve elements don't know yet. As individuals, they would be fairly well prepared from experience in the last war. But, to be effective any time soon after M-day, they will have to be assigned and trained in units. That is the big organization job still to be completed.

The Air Force, of course, has only been cut loose under its own Department for a year and has encountered problems enough in setting its regular establishment to rights. Meanwhile, the Guard and Reserve have not been unsnarled from Army control under the Unification Bill and have had to wait for higher-up decisions beyond Air Force control.

The High Command, preoccupied with manning the Army by compulsory methods, long worked for universal military training as its main goal and finally was given a new draft law. Though Air Force and Navy can get volunteers full time and part time, the topside thinking has been in the direction of conscript mass armies.

In particular, the civilian components of all the Armed Forces have been waiting for policies to be recommended by a committee headed by Gordon Gray, Assistant Secretary of Army. The Gray Committee report, urging merger of the Reserve and



Maj. Gen. Lucas V. Beau

National Guard, stirred up considerable controversy, and no official action has resulted.

It is hoped that once a blueprint is provided to show how the major pieces fit together, work can start in fabricating some of the parts which as yet are just stockpiles of raw material, so

to speak. Until then, we can only report on the situation as it now exists.

Air National Guard

Priority has been given to completion of Air National Guard units which would have the immediate M-day role of going into action with tactical aircraft, fully equipped and manned. So the Guard has made fast progress as compared with the larger but mostly unemployed Air Reserve.

Total complement of the Air National Guard is 7791 officers and 50,035 enlisted men. Earlier in the year, the actual strength stood at some 4000 officers and 18,000 enlisted. But the enlistment spurt after passage of the selective service law boosted the total to 29,000 as of the end of June, and recruiting is vigorously continuing.

Of 514 air units planned, nearly 400 are active in all States but Rhode Island. The Guard has some 2000 airplanes, mostly tactical, for about 2500 pilots now; will have 2290 plus 10% storage for 3189 pilots at full strength.

There are 21 groups, 60 fighter and



Three officers of the 4th Bomb Wing, First Air Force, at Mutchel Air Force Base, check a map before a flight. Such Air Force Reserve training is conducted at 41 bases throughout the country

10 light-bombardment squadrons; well on the way toward the 24 fighter and three light bombardment groups in total complement. Of \$240 million for the whole National Guard in the fiscal year ending June 30, 1949, \$70 million goes for air. This will cut flying time to about 110 hours per pilot as compared with 180 requested and 300 to 400 for fighter pilots on active duty. But it is a plush program as compared with other components.

Air Force Reserve

Composed of 234,000 officers and 194,000 enlisted men, mostly veterans of the past war, the Air Force Reserve is the biggest organization of military airmen in the Air Force team; bigger than the regular Air Force itself. Lacking the political influence of the Guard, which is tied into the 48 State Governments, and lacking also the immediate M-day function of the Air Guard units, the Reserve has faced many setbacks and delays which only now are beginning to clear away.

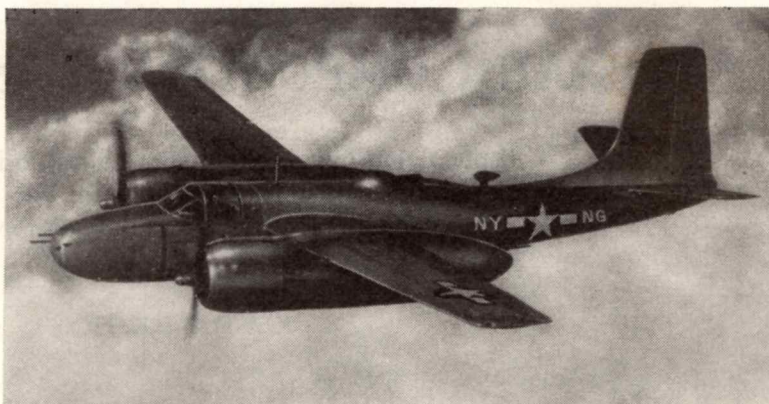
Two years ago, an ambitious program of training at Air Force bases was announced. Before it had reached the halfway point, it was cut back. For lack of airplanes . . . mostly obsolete trainers at that . . . and Pentagon vagueness over all, the Reserve has held the interest of only a fraction of its officers and fewer enlisted men.

Only about 90,000 officers and 44,000 enlisted are currently enrolled for training. Those actually doing anything are only a small fraction of this number. Note the disparity in ratio between officers and enlisted. Last summer only 14,000 officers and 4800 enlisted Reservists were on 15-day tours of active duty.

Air Reserve planes, AT-6's for the most part, are to be increased in number to 1325 this fiscal year. Originally the complement called for only 125 tactical (combat-type) aircraft, but it now appears that the number will be substantially larger.

The full program calls for 34 groups to total 964 units. Only 271 units have been activated and but four are class A; 98 class B. Lack of funds, aggravated by mounting costs of plane operations and maintenance, has limited the development of busy units. Lack of unit activity in turn has reacted against appropriations.

Concerning the Reserves as a whole, the House Appropriations Committee reported that it was "not impressed with the presentation of the needs for funds requested or with the manner in which this program is being conducted." Neither are the reservists themselves. They have had many



Douglas "Invader," one of the most successful attack bombers of World War II, is now used by Air National Guard units. Under new USAF designations for all types of bombers, plane is now the B-26

gripes. Legislation for inactive-duty training pay and for retirement pay, however, at last has put them closer toward parity with the Guard and with the excellent Naval Air Reserve in that respect.

Gradually a better deal is coming. Top officials in the Department of Air Force are more aware of the needs than ever before. Leading reserve officers who met with them a few weeks ago are convinced that their program will be moving upgrade from this point on—slowly perhaps this year but much faster next year. As more encouraging word goes down the line to the reservists across the country, improvement of morale and of activities will follow.

Still to be considered is the development of local volunteer programs around the little airports with some contracting for use of privately owned

planes which would help the fixed-base operators no little. The Army has such an arrangement for flying of its reserve liaison pilots, but the Air Force thus far has concentrated most of its work around a few big bases and has left the reservists out of reach of these stations with little or nothing to do.

The Air ROTC, to bring more youngsters into the service, is going in 96 colleges with 24,500 students; will expand to 119 colleges and 40,000 students next year, though funds are a bit short. Some 2300 will graduate this year; 3300 next. Private flying schools, though given no break as yet in connection with Reserve training and flying, have some hope of contract flight for ROTC.

Civil Air Patrol

More civilian than the Reserves and
(Continued on page 153)



Instructor Lee Morgan demonstrating important art of parachute packing and rigging to members of the Michigan Wing, Civil Air Patrol. An Air Force auxiliary, CAP is trained for a variety of military and home-front duties



Bird's Eyes are PLEXIGLAS

The "eyes" of North American Aviation's B-45 bomber, first multi-jet airplane to fly in the United States, are PLEXIGLAS.

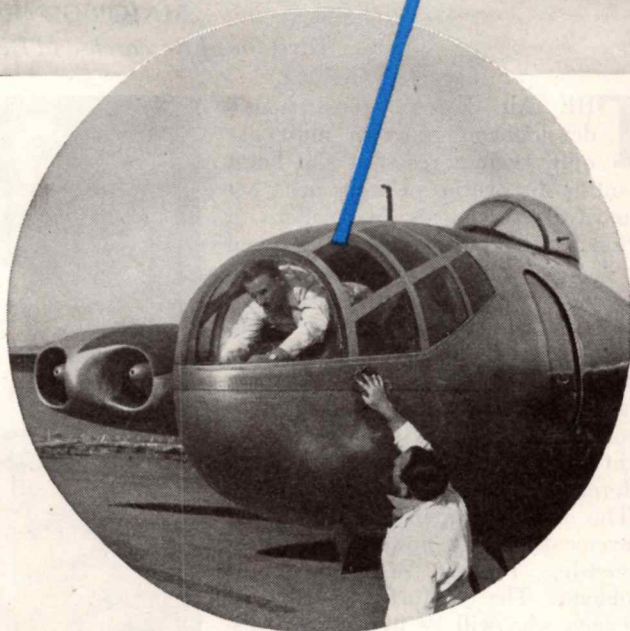
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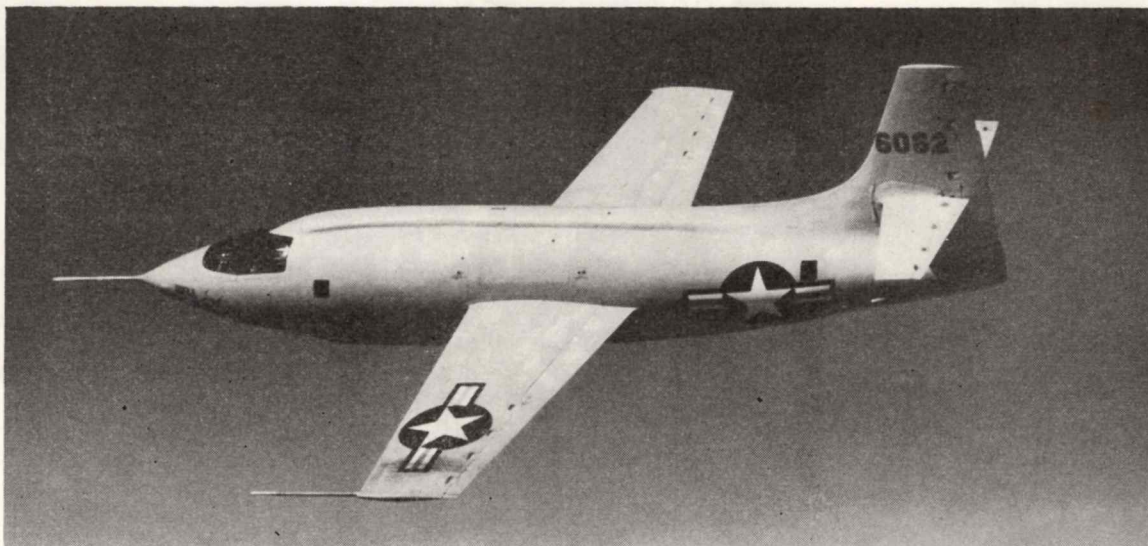
PLEXIGLAS pilot's bubble and greenhouse of North American Aviation's B-45, one of the first U. S. jet operational bombers, and first multi-jet to fly in America.

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First piloted aircraft to exceed the speed of sound is the rocket-powered X-1, a USAF-NACA-Bell project

AIR FORCE RESEARCH and DEVELOPMENT

MAJOR GENERAL L. C. CRAIGIE

Director of Research and Development, Hq., U.S. Air Force

THE Air Force's research-and-development program must not only keep abreast of the latest scientific discoveries in every field, but it must also create its own pattern of action for both immediate needs and the far future. Air Force adaptation of new strategic principles calls for new technical ingenuities. In recent years, the possibility of Arctic warfare with extremely long-range bombing missions has demanded larger types of aircraft and different kinds of equipment from any that have been known before.

The emphasis upon mechanical improvements has not, however, prevented increasing concern with personnel problems. The comfort and safety of the men who will be flying great distances in all kinds of weather, at extremely high speeds and altitudes, is a primary consideration of all phases of research and development. Aero-medical technologists, for example, match every development in plane construction; when aircraft are designed which fly at speeds and heights formerly thought impossible, the aviation-medicine specialists are consulted in connection with the design of pressurized cabins and new types of clothing which enable personnel to meet these conditions.

This stressing of human problems is extremely important in research and development, which are too often regarded as merely mechanical functions. But all the research in this direction is turned not only to adjusting crew-



Maj. Gen. L. C. Craigie

men to difficult flying conditions. That is but part of the problem. Psychological research has shown that the new uses of air power are also making intensified demands upon ground personnel; assignments to outposts in frozen wastelands will be made on the basis of each man's adaptability to such conditions. Once again, this is not the end of the problem, for, after personnel are assigned, they will have to be kept at a peak of well-being and efficiency.

Realization of the interplay between mechanical and human factors is, however, only one of the many obligations

of research and development. This many-sided activity requires widespread cooperation as well as control of many possibly conflicting elements. Recent achievements along mechanical lines are a testimony to the coordination that has been established; they represent a combination of various technical improvements that have been patiently worked out over a long period of time by Air Force specialists collaborating with civilian scientists.

The activities of research and development demonstrate how smoothly the principle of unification can be made to work. Before the Air Force sets a project going, it is coordinated with all agencies interested. These might include the Army and its technical services, the Navy and its bureaus, and other Federal agencies concerned with the particular type of project under consideration. One of these groups frequently consulted is the Research and Development Board, headed by Dr. Vannevar Bush and made up of leading scientists in various fields. This supervision of each project assures that the maximum of knowledge and skill is brought to bear on it, and that the most useful expenditure of funds is made.

The Research and Development Directorate of the Air Force is located at Headquarters, Washington, D. C., where it performs several directive and advisory functions. It keeps in constant touch with pertinent developments in aeronautics and related fields and continually advises the Air Force

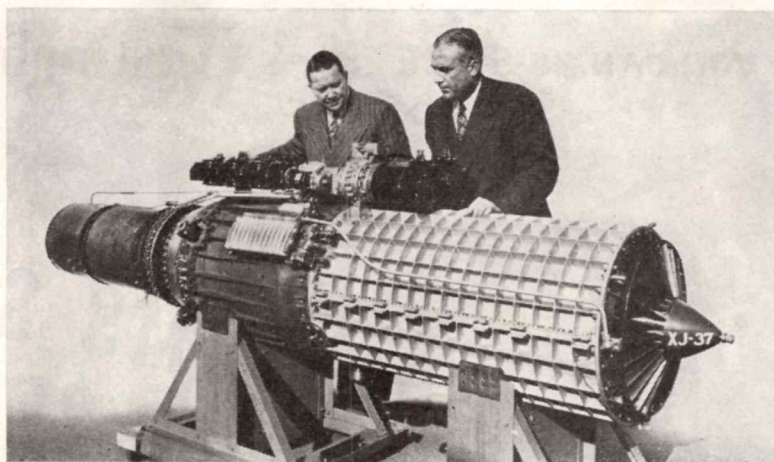
about these. The directorate also acts as an advisory agency, for research and development, to the Chief of Staff and to the Air Force segment of the Joint Chiefs of Staff. It cooperates with Personnel and Administration on plans for mobilization of technical specialists in event of emergency.

In relation to the Air Materiel Command, the Research and Development Directorate not only serves in its general advisory capacity but also instructs the Command, in the name of the Chief of Staff, to initiate programs that have been determined upon. The directorate supervises these activities only in the broad sense, suggesting more emphasis on one project or curtailment of another; it does not direct the Air Materiel Command in details of procedure.

This thoroughness of coordination all along the line has resulted in sound plans and sound production, consistent always with the tactical and strategic needs of the Air Force. Planes of World War II vintage are still predominantly in use, but research and development are creating new aircraft to meet the demands of warfare of the future.

The Big B-36

Largest of the new planes now in production is the B-36. This is a pusher type (propellers behind the wings), with a maximum bomb capacity of more than 30 tons. It has the greatest range of any Air Force plane and is large enough to carry in one of its bomb bays a "parasite" fighter to be released when contact with the enemy is anticipated.



Lockheed v.p. Hibbard (left) and inventor Nathan C. Price inspect the XJ-37, potentially America's most advanced turbojet engine

The range and size of the B-36 and of other bombers planned for the future have reduced the B-29 to designation as a medium bomber. This may be a startling bit of information to those who recall how impressive the first *Superforts* were only a few years ago, and how large they seemed in relation to the B-17's which they succeeded. The latest adaptation of the B-29 in its new classification is the B-50.

It is important to note that the previously mentioned B-36 is a conventional type of aircraft, and that it is not as fast as a jet plane, although it has greater range. Of the jet bombers, the largest that is in the experimental and test stage is the YB-49, the "Jet Wing," which has eight engines and is patterned after the conventionally propelled "Flying Wing."

The principal difficulty in the way of developing jet bombers is the high rate of fuel consumption of most jet engines. This has delayed construction of heavy bombers of this type, which in a future war might have to fly long-range missions with no refueling bases within range. The Munitions Board and the Research and Development Board are working hand in hand with the military services in an effort to overcome this jet-range problem by increasing emphasis on developments of fuels of higher energy content and by improvements in the engines themselves.

Greater success has been attained with light bombers propelled by jet powerplants. The principal development in this category is the B-45, now in production as the eventual replacement of the A-26. The B-45, of which nearly 200 are being produced, is powered by four jet engines arranged in pairs in single nacelles. Its speed of nearly 500 *mph* places it in the same high-speed category as our fighter aircraft. Its bomb-carrying capacity is more than ten tons.

Jet production has been most successful in the case of fighter planes. The present F-80 and F-84, which are becoming the principal aircraft of the fighter force, were developed during World War II (as the P-80 and P-84), but did not see combat service. They will soon be augmented by the F-86, our first sweptback-wing fighter. Like the F-80 and F-84, it also incorporates a pressurized cabin and a tricycle gear.

Like the F-80 -84, the F-86 is in the 600-*mph* class, with a service ceiling of more than 40,000 *ft*, and, also like these planes, it has a pilot-ejector seat which permits the pilot to escape from the aircraft with his parachute in case of emergency when the plane is traveling at a high rate of speed. The

(Continued on page 141)



Test Operator Roblee (left) and Chief Test Engineer Leverette inspect a fuel pump on the J35 turbojet engine undergoing tests in the climatic hangar at Eglin Air Force Base (Fla.). Temperature, -65° F.

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One reason for the success of the test was the faultless per-

formance of the Yankee (J-30WE) Turbojets—power plants of the Phantoms. Engine starts were unfailing. Performance was excellent—with no engine trouble throughout the four-day test. What's more, the ship's crew liked the jets—liked their much lower noise level . . . the accessibility of the engines—the convenience of handling.

Thus, in the first full-scale, tactical jet operation, the Navy gave an enthusiastic "Thumbs Up". Again, the Yankee Turbojet engines have proved their practicability in operation with the fleet. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50493

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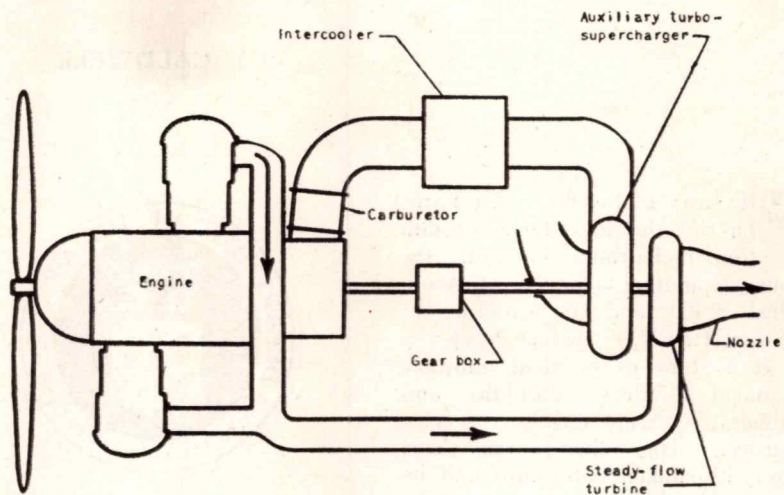
The "Yankee" Line of Turbojet Engines

Compound Engine

IN THE face of really long-range, inter-continental commitments, the U. S. Air Force is not missing any bets that promise to add from 20% to 30% range for its heavy bombers and strategic transports. The answer is found in the compounding of an exhaust-gas turbine with a reciprocating piston engine. The writer heard this discussed in some detail in June, 1945, while attending the confidential-level Air Force-General Electric Gas Turbine Engineering Conference at Swampscott, Mass. Recently, odd bits and pieces on the subject have been breaking into print, so it may be that a brief roundup is in order.

It has been commonly explained as a process whereby the turbosupercharger is compounded with the engine so as to utilize the energy of the exhaust gases formerly wasted. It was a natural development of the turbosupercharger, and engineers have been working on it for some time.

The accompanying NACA diagrammatic sketch shows a compound engine consisting of a conventional piston engine, a steady-flow exhaust-gas turbine, and an auxiliary supercharger. The engine-exhaust gas (at temperatures and pressures for which a gas turbine is well suited) is ducted to the turbine, which is provided with a nozzle for jet propulsion. The turbine drives the auxiliary supercharger and the excess turbine power is delivered to the engine shaft through gearing,



Diagrammatic sketch of compound engine. Arrows show how the exhaust gas is ducted from each cylinder to the turbine, which drives both the auxiliary supercharger and the drive shaft with its reduction gearing

as the high *rpm* of the turbine has to be brought down to the 2000-plus *rpm* of the engine.

GE Development

A highly developed form of the compound engine is the Pratt & Whitney R-4360 Variable Discharge Turbine engine (*Wasp Major VDT* for short). The gas-turbine elements in this very important project have been developed by General Electric. This project is sponsored by the Air Force as a top-priority item. An earlier development of a compound engine based on the liquid-cooled Allison V-1710 was dropped a couple of years ago so that Allison engineers could concentrate on the development of the J33 and J35 turbojet engines and on advanced turbine propeller units.

The first installation of the *Wasp*

Major VDT is in the modified Boeing B-50C, reportedly redesignated B-54, which will take four of the units. Some 15% increase in power permits 4000 *hp* for take-off. Maximum cruising power at 30,000 *ft* is slightly under 3900 *hp*. This would give the B-54 a top speed of better than 450 *mph*.

The specific fuel consumption decreases with increasing altitude as a result of increased turbine power. For the cruise condition this *sfc* is 0.51 *lb per hp/hr* at sea level, and 0.40 *lb* at 30,000 *ft*. NACA studies, on which these figures are based, indicate that for an aircraft of the size and weight of the B-50, the maximum range at 30,000 *ft* and at its best cruising speed would be 10,000 miles, plus or minus, more exact results to be known through extensive flight tests.

Another planned Air Force installation is the propeller version of the Northrop B-35 flying wing.

The Navy has shown more interest in the compound engine developed by Wright Aeronautical Corp. This is a *Cyclone-18* with three additional turbines, which develops over 3300 *hp* for take-off and 3200 *hp* at 30,000 *ft*. The first installation will be in a modified version of the Lockheed Neptune (XP2V-4), others to include four units in a modified Lockheed XR-60 Constitution, and a North American attack bomber for carrier operations (XAJ-1) which will take four compound *Cyclones*, plus a turbojet unit for booster power.

Eventually, to gain the full benefit from the compound engine, beefed-up versions of the present engines will be necessary, with stronger pistons, cylinders, bearings and crankshafts.



This flight view shows the unusually clean Martin XB-48 six-jet bomber speeding over Chesapeake Bay during the intensive flight test program conducted by the Company in cooperation with the USAF. The first model has been undergoing tests at Wright-Patterson Air Force Base, while company pilots test the second prototype

THE U.S. AIR FORCE, 1909-1948

CY CALDWELL

THE story of the U. S. Air Force has all the ingredients of old-time melodrama, including the jealous stepmother (the U. S. Army General Staff) and the spiteful old maid aunt (the U. S. surface Navy).

It is a story of political, military and naval blindness, stupidity and selfishness; of Army and Navy service jealousies. The climax was Pearl Harbor, its sunken battleships and its three thousand American dead: the curtain-raiser for the war with Japan, which a strong U. S. Air Force in being probably would have prevented.

To guard against war, be strong; to invite war, be weak. Of the truth of that statement, all history stands in evidence, as even land generals and surface Navy admirals will agree. What they cannot—or will not—agree upon is *how* a nation should be strong. Appropriate a tax dollar for air power, and watch the Army and Navy stand, with outstretched mendicant hands, expecting another dollar each—or a billion dollars each.

"We must be strong everywhere," they cry, "on land, at sea—and in the air." But to strive for strength everywhere is to achieve it nowhere in sufficient force to be overwhelmingly decisive.

The same solidly-entrenched forces that selfishly held back air progress for over 30 years still are at work. In the 39 years since the U. S. Army bought its first little Wright biplane, human nature hasn't changed. Nor has the Army or the Navy; nor big industry; nor most of the politicians, who will bellow like injured buffaloes if anyone dares to suggest that a naval base or an old Army fort in their district—built originally to control the Indians—is not a necessity of modern warfare. Even the Army's antique Coast Artillery, aiming its utterly useless guns at passing whales, will stoutly assert that it is defending the nation, when any sane man knows that it should be stuffed and put in the Smithsonian Institution beside the dinosaur.

In an acceptance test at Fort Myer, Virginia, Aug. 2, 1909, Orville Wright stayed aloft for 1 hour, 12 minutes and 40 seconds, at an average speed of 42.5 mph, in a Wright Model A with a 25-hp engine that cost the Army \$30,000—which it scraped from avail-



able funds of the Signal Corps. Congress made no appropriation.

In 1910, our entire air service consisted of Lieut. Benny Foulois, nine enlisted men, that one Wright plane, a single airship, and three balloons that leaked. In March, 1911, Congress reluctantly voted \$125,000 for aeronautics. It was used to establish the first military aviation school, at College Park, Md. (where Lt. H. H. Arnold, among others, made some early flights), and to purchase a few planes from Wright and Curtiss. In the fall of 1912 these were delivered—by railroad.

Unwanted Child

The Aviation Section, Signal Corps, was created on July 18, 1914, with 60 officers and 260 enlisted men authorized—but not appropriated for. The Signal Corps asked for \$500,000; Congress gave it only \$300,000. In April, 1915, the War Department sent one airplane section to Brownsville, Texas, to help deal with Pancho Villa, who eluded not only the lone airplane but the U. S. Army under General Pershing, as well. The operations of the First Aero Squadron against Villa's forces in 1916 served chiefly to demonstrate that all of the equipment was unfit for war work.

In 1916, while the U. S. Army was nursing and under-feeding this incubator baby of air power, the World War already had been in progress for two years. Germany had begun the war with some 1000 planes, England with 250, France with 300. Despite war losses, these countries had been increasing their air arms and rapidly developing new and improved types of combat planes. The Army paid no attention.

Prodded by severe press criticisms of our feeble air operations in Mexico,

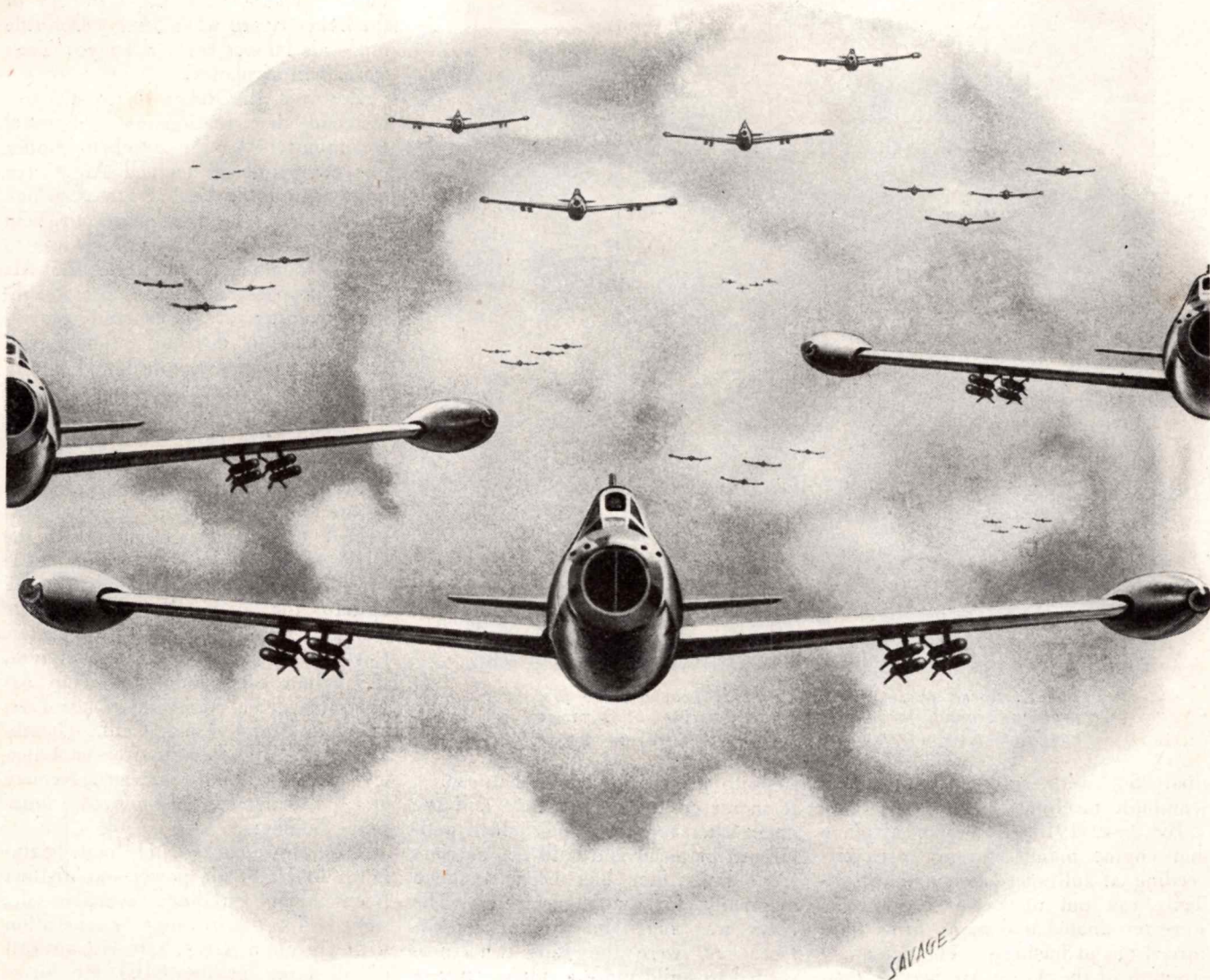
Congress finally noticed the air war in Europe and, on June 3, 1916, passed the National Defense Act, which authorized for the Signal Corps a personnel of 148 officers and 4,000 enlisted men. It also appropriated \$13,281,666 for aeronautical development. But development takes time. When we declared war on April 6, 1917, our Army aviation consisted of only 65 officers, of whom but 35 were flyers, and 1087 enlisted men, most of whom were raw recruits.

Little Equipment

The flying equipment consisted of 55 airplanes, 51 of which were declared obsolete—and the other four not much good. With no airplanes suitable for service against a well-equipped enemy, with no pilots trained in the use of higher-powered European combat types, with no machine guns mounted on any airplane, with not more than half a dozen tiny airplane and engine factories in the country, the United States plunged into the greatest war the world yet had seen. That summarizes America's complete lack of realization of the possibilities of aircraft for military purposes during the first 14 years of the existence of powered flight!

We had no design for a modern combat plane, so we went to the fellows who had designed our Army and Navy uniforms—the British! They came across with the de Havilland 4, day fighter and bomber. We adapted it for production with the projected *Liberty* engine. The design was ready on June 4. On Oct. 12, 1917, the first 12-cylinder *Liberty* was flown, less than five months from the day the design was begun. By Nov. 11, 1918, 13,000 *Liberties* had been turned out and production stood at 150 engines a day. 2574 had been sent overseas and 1500 more were at the ports or in transit. The *Liberty* engine was our one outstanding contribution to wartime aeronautical development.

By April, 1918, we had graduated 3114 American pilots and observers trained on Curtiss "Jennies." Our aviators were credited with the destruction of 491 enemy airplanes, of which 462 were accounted for by 63 pilots. We had 43 squadrons at the front at the armistice, but of these less



PERFECTING ON SCIENCE...

When you see a jet propelled Air Force fighter or bomber plane speeding overhead . . . consider the time and effort taken to get it there. ¶ The REPUBLIC F-84 THUNDERJET first flew in February, 1946. Leading up to that important day, well over 500,000 engineering manhours were spent in putting together what was then known about the vexing problems of jet propulsion and high speed performance to create the first of these now-famous 600 mph jet fighters. ¶ Since then, several hundred Thunderjets have taken their place with various groups of the USAF . . . Another half-million engineering manhours have added greatly to the performance and utility of the F-84 . . . To keep abreast of changing operational techniques, more than 400 major design improvements have been made between the first prototype and today's F-84C. ¶ And that's not all. New jet developments, along with new experiences in actual Air Force operations, are expected to require at least 300,000 engineering manhours per year, in order that the THUNDERJET will consistently satisfy ground crews, pilots and commanders . . . maintaining its leadership among the modern planes assigned to guard our peace and security.



"This Is the Year of the Thunderjet"

REPUBLIC  AVIATION 

Makers of the Mighty Thunderbolt • Thunderjet • XF-12



The European phase of World War II provided the first proving ground for the airmen's doctrine of strategic bombing, plus unprecedented use of tactical air power

than 25% were equipped with American-built machines.

By Nov. 1918, American airplane and engine manufacturers were proceeding at full speed, when they suddenly ran out of a war. Contracts were terminated and many firms were forced out of business. The personnel strength of the Army Air Service then was 18,000 officers and 135,000 enlisted men; but it soon dwindled to 1000 officers and 10,000 men, who for the next few years flew around in wartime equipment.

They Couldn't Take It

In 1921, the Army and Navy air arms started a trial war of their own against the battleship. In June, Navy F-5-L patrol planes dropped bombs on the ex-German submarine U-117 and promptly sent it to the bottom, to the annoyance of our Navy. Then Army and Navy planes sank a captured German destroyer. The Navy stopped its own airmen!

In July came Billy Mitchell's famous test on the *Ostfriesland*, ex-German battleship whose underwater construction was as good as that of any American battleship built at the time. When 1100-lb and 2000-lb bombs were used, the ship was capsized and sent to the bottom. In September, the old U. S. battleship *Alabama* was used as a target—and was sunk by a single 1100-lb bomb that did not strike the vessel but landed close alongside!

The alarmed Navy took immediate

steps to protect its sacred battleships. It increased the deck armor and the underwater compartments, added anti-aircraft batteries and built two carriers from hulls that had been designed originally for battle cruisers. The Navy was alert and thinking on its feet! So were the Japs, who proceeded to build more airplane carriers from which bombing tests were conducted at Pearl Harbor, 20 years later. And again, just as Billy Mitchell had predicted, the battleships were sunk by bombs. Unfortunately, they were *our* battleships this time.

During the 1920's and early '30's there were various inquiries, investigations and reports as to the status of military aviation. The Baker Board, in 1934, came up from the depths with this historic utterance, "The limitations of the airplane show that the ideas that aviation, acting alone, can control the sea lanes, or defend the coast, or produce decisive results are all visionary, as is the idea that a large air force is necessary to defend our country." That was based chiefly upon Army and Navy testimony.

The Baker Board had one knowing and intelligent member, Jimmy Doolittle, who wrote a minority report: "I believe that the future security of our nation is dependent upon an adequate air force. This is true at the present time and will become increasingly important as the science of aviation advances and the airplane lends itself more and more to the science of war-

fare." Where were the members of the Baker Board when Jimmy Doolittle made his famous raid on Tokyo? They weren't in airplanes!

However, the Baker Board did recommend the creation of a General Headquarters Air Force to bring under one command all tactical Air Corps units within the United States, which had hitherto been attached to field armies. This GHQ Air Force was to be the combat outfit while the Air Corps proper continued to provide initial training of pilots and ground crews and to develop, procure and service airplanes, engines and equipment. The Army and Navy didn't mind too much—for it split the Air Corps into two parts, both still under the General Staff.

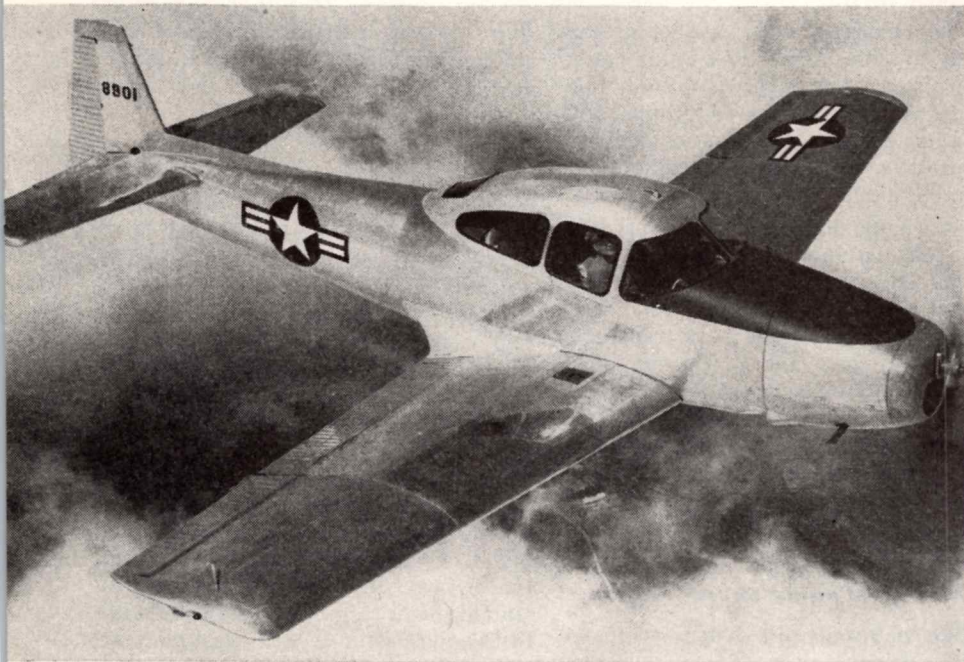
Frank M. Andrews, a cavalryman before he became an airman, was named Commanding General of the GHQ Air Force. He immediately chose for his chief of staff Hugh Knerr, an agitator for big bombers, and George Kenney, another Mitchell supporter. Carl Spaatz was placed in charge of the fighter command, while Hap Arnold was given command of the First Wing at March Field, Calif., (bombers). At GHQ Headquarters at Langley Field, Va., Andrews, Knerr, Kenney and McNarney started to develop long-range bombers.

This step marked the real beginnings of U. S. air power—as distinct from Army auxiliary aviation, designed for short-range cooperation with a ground Army. Of 412 aircraft of all types in the GHQ air force, only 174 were declared to be modern and suitable for anything in war. Of these, the best were some 40 Martin B-10 and B-12's, two-motored bombers. During the years since 1930, from experience gained with these planes, Col. Knerr and Col. Howard drew up a ten-year development program for long-range bombardment planes: four types, each progressively larger, faster and with a bigger bomb-carrying capacity for longer distances. The first to be completed was the Boeing B-17, the *Flying Fortress*.

Rideaway Landings

By 1937, the GHQ Air Force received three B-17's, with a bicycle as standard equipment. If a pilot crashed a B-17 he was expected to mount that bicycle and ride off into the wilderness, never to return! After testing and eliminating bugs from their three treasures, General Andrews and Colonel Knerr prepared a program for the War Department, calling for the construction of 108 B-17's and for enlarging Pacific island fields so that big bombers could operate all the way across the Pacific to the Philippines.

AGAIN ARMY BUYS RUGGED NAVIONS



158 Ryan Navions To See Service With United States Army

A NEW ARMY ORDER for 158 *Ryan Navions*, recently announced, brings the total of these sturdiest of modern 4-place planes for Army service to 241. First *Navion* orders were placed in 1947 following evaluation of quotations and testing of all 4-place planes entered in an Army competition.

The Army's repeat purchase of *Navions* is of particular interest to business and personal plane pilots because military service operation of these planes is regularly under more severe conditions than civilian owners would normally encounter.

An important fact which makes the *Navion* adaptable to Army service is its ability to operate safely in and out of small fields, together with its excellent all-around performance, roominess and exceptionally rugged construction.

The *Navion* is widely recognized as outstanding for its 360-degree visibility and its over-the-nose vision when flying and taxiing. It also excels in smooth riding—even in rough air—a point which contributes much to relaxed, fatigueless flying. Exceptionally safe and easy to fly because of its fine stall-resistant characteristics and built-in coordination of controls, the *Navion* is the *safest, most practical and efficient* 4-place plane.

WRITE FOR FREE NAVION TRIP

So you can see how the *Navion* can be used profitably for *your* transportation, we would like to put a *Navion* and pilot at your disposal for your next business trip—absolutely free. Write for illustrated booklet and name of *Ryan Navion* dealer who will arrange flight demonstration at your convenience.

HERE'S ONE OF THE 4-PLACE NAVIONS now in the United States Army service. Except for its military insignia, and certain military equipment, the L-17 *Navion* is the same as the standard *Ryan Navion*.

CARGO-CARRYING FEATURE of the *Navion* is of importance to either military or business user. The *Navion's* exclusive rolling and removable canopy makes possible the loading of extremely bulky objects such as this transport plane wheel. Up to 645 lbs. in 55 cu. ft. of space can be carried.



DEMONSTRATION involving taxiing through sand, ruts and heavy brush brought out the ability of the thick-skinned, all-metal *Navion* to withstand heavy duty usage. Tests of cross-wind take-offs and landings also emphasized the advantage of the *Navion's* sturdy tricycle gear with its large steerable nosewheel.



The Thoroughly Proven Post-War Plane

Ryan Navion

Rely on Ryan

RYAN AERONAUTICAL COMPANY •

LINDBERGH FIELD, SAN DIEGO 12, CALIFORNIA

The expansion was to cost \$21,000,000—less than the cost of a single light cruiser—which Japs sank with ease.

Thus, since 1930, the fight for air power in the Air Corps had revolved around two irreconcilable ideas: the air officers wanted to develop long-range bombardment in order to be able to attack far out at sea any invasion force approaching our shores; the Navy wanted to retain its position as "our first line of defense" and didn't want any Army airplanes flying over its oceans. As for the Army, it wanted the airplane tied to the Army as an auxiliary. That's the basic story—the story of Army-Navy jealousy of the new war science of aviation.

The War Department managed to kill the bill that would have given the GHQ Air Force 108 B-17's. It died in committee. The Philippines almost died later. The discarded plan for heavy bombers and properly equipped bases would have saved the Philippines. As Andrews, Knerr and his staff had tried to get Congressional support over the heads of their superiors, and as they had protested against the sacred Army-Navy 300-mile limit for bombers, they got the axe. Andrews was banished to an Army post in Texas, reduced from major general to colonel; Knerr was reduced in rank and "retired" from the Army; Kenney was sent as an instructor to the Infantry School at Fort Benning; Lt. Col. Joe McNarney was exiled to the West Coast. Their outstanding contribution to World War II, and the present key posts of the survivors in the new U. S. Air Force present a dramatic reversal.

In 1938, when Hitler won the Battle of Munich largely with the threat of German air power, General Arnold became Chief of the U. S. Army Air Corps. We were then turning out some 500 pilots and 1000 airplane mechanics a year. We had 17,000 officers and men and a few hundred serviceable aircraft. In August, 1939, the Air Corps expansion program was put under way, with a goal of 5000 modern combat planes and a stepped-up training program. In September, Hitler conquered Poland in 26 days, largely by air power. After the conquest of Norway and the Low Countries in the spring of 1940, and the impending collapse of France, President Roosevelt called for 50,000 military aircraft and an annual productive capacity of that amount.

General George Marshall, who replaced General Malin Craig as Chief of Staff in 1939, recalled the rebel air officers from exile and, in June, 1941, the Army Air Force was given a semi-autonomous status, with its own air staff. Robert A. Lovett was appointed

Assistant Secretary of War for Air. American industry swung into action, and companies that had been building automobiles and refrigerators suddenly started turning out airplanes and engines from aviation-industry designs.

By the summer of 1941, with Hitler conquering the Balkans and Crete and the Japs moving fast in Southwest Asia and the Pacific, Air Force pilot training was approaching the rate of 12,000 a year, with 30,000 to be trained in 1942. The Air Force was to be enlarged to 25 combat groups, then to 54 groups. Just before Pearl Harbor, a thoroughly aroused Congress voted funds for 84 groups, with announcements of personnel increases from 100,000 to 250,000 to 600,000 coming along within a few months.

When the Japs struck at Pearl Harbor, our national air strength was 3305 supposedly combat planes, of which 1024 were overseas; non-combat types included another 7024; 216 transports, 6594 trainers, and 214 communications, of which only 98 were overseas in the Pacific Area, the Far East, Alaska and the Canal Zone. During the first month of the war, 212 planes were despatched overseas, making up only half of the months' overseas losses of 412 combat planes.

Caught Short

We had only 19 B-17's—with no power-driven turrets, no tail guns, no protective armor, no self-sealing gas tanks. We had no long-range fighters. Only two squadrons of twin-engined attack planes and a collection of fighters that were declared obsolete when compared with England's *Spitfires* and Germany's *Messerschmitts*. We even had training planes with machine guns mounted on them, which the War Department classified as fighters! Such was the development of air power under the heavy hand of the War Department when we entered the greatest war in history.

The aircraft industry of the nation had employed only 48,000 workers in 1939. But it assumed responsibility for an expansion program that was to bring in as sub-contractors companies that had made brassieres and apple butter and pipe-organs. William S. Knudsen, production genius of General Motors, was commissioned a lieutenant general and put in charge of production. He chopped his way through Army regulations and red tape and got American industry organized.

By July 1942, 4-engine B-17's and B-24's were coming off the lines 100 a month. Twin-engine medium bombers totaled about 350 a month. Fighter production was on the upswing: new

P-38's, P-47's and P-51's (the last named mostly for the British, until they showed us how good the P-51 was) a bit over 200 a month, and older P-39's and P-40's around 600 a month. The C-47 transport was coming off 150 a month, and training planes were around 1500 a month; the C-54 was just coming into production. In the first six months of the war, to July, 1942, the weight of airframes produced had more than doubled, to over 21 million pounds by July. It was a major miracle of production, performed by American industry and the Materiel Command.

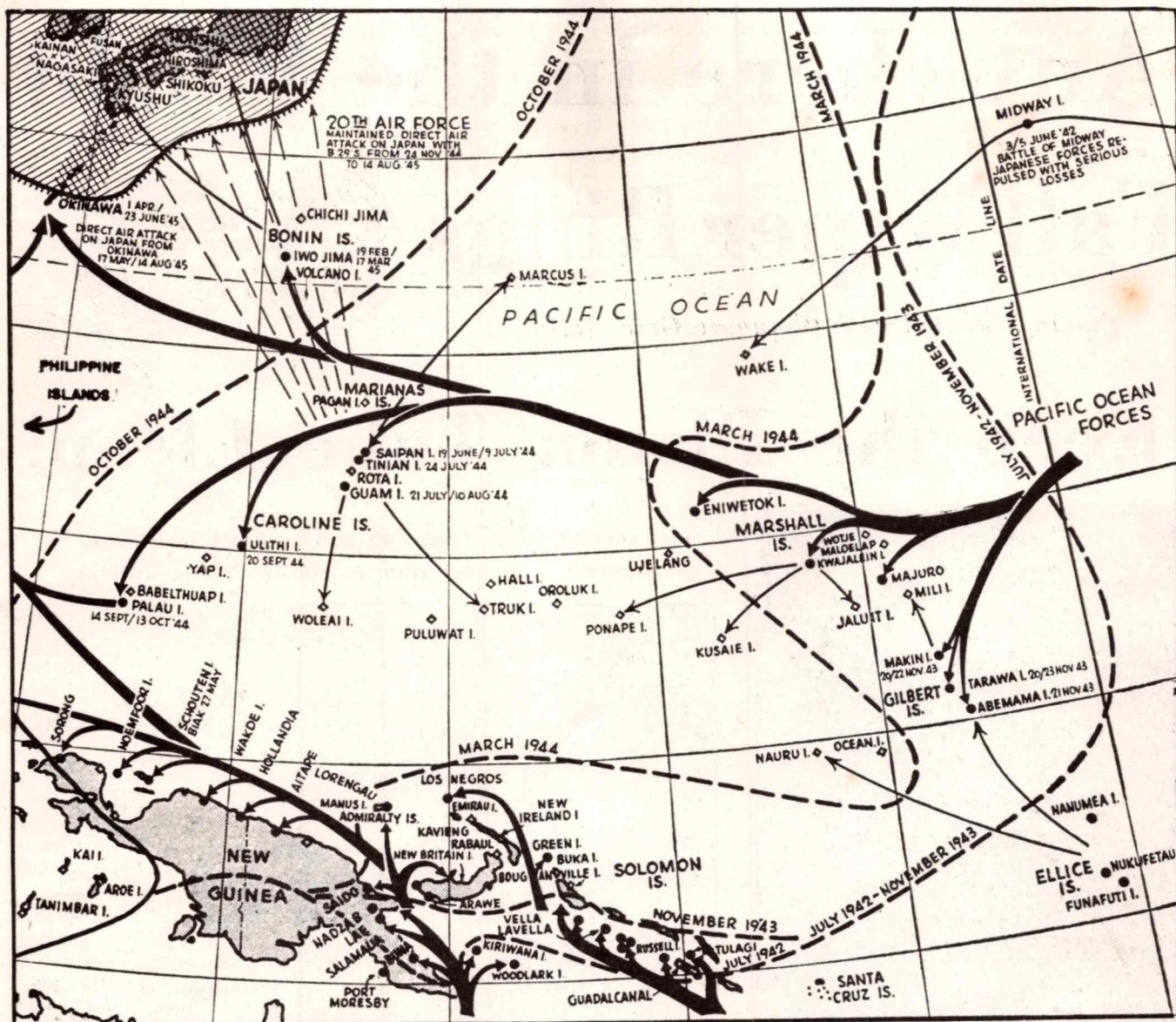
Building Manpower

During this period the Flying Training Command was making tremendous progress with the help of the output of civilian flying schools, in which 25,574 students had been enrolled at the time of Pearl Harbor, and of which 7793 had won their wings when war came. Over 10,000 were still under Training. The Civilian Pilot Training Program in the colleges, started by Robert H. Hinkley, Assistant Secretary of Commerce, produced an impressive proportion of AAF medalists (pilots) during the war. The Ferrying Command, Troop Carrier Command, and the Airways Communications System started practically from scratch, with little equipment. Yet, in its first year of operations, the Ferrying Command flew 3513 airplanes to destinations in the U. S. and 638 overseas, carrying 1920 tons of mail and cargo. (On May 29, 1941, the Ferrying Command had consisted of Colonel Robert Olds, one other officer, and a civilian secretary.)

Drastic streamlining and reorganizing of the Army was completed in March, 1942, by General Marshall, with three co-equal branches: the Army Air Forces, Army Ground Forces, and the Army Service Forces. General H. H. Arnold became Commanding General of the Air Forces, combining the Air Force Combat Command and the Air Corps into one organization. General Marshall announced the goal of the AAF as one million in 1942, with double that number by the end of 1943.

So far, we'd only been getting ready for war, with Germany as principal antagonist and our operations in the Pacific limited to holding the southern advance of the Japs. The early operations of our Eighth Air Force in England began in August, 1942, with the daylight assignment in the joint air offensive with the night-flying Royal Air Force Bomber Command, to weaken the German military potential.

American Air Force doctrine followed the ideas of General Mitchell



In the wide reaches of the Pacific the Air Force met its greatest challenge and achieved its most spectacular triumphs

and the Italian General Douhet, including the principle that long-range bombardment is the keystone of air power, to smash the enemy industry far behind his lines, to cripple his communications and vital key industries, such as aircraft and engine factories and factories making ball-bearings or instruments, or the cracking plants producing aviation gasoline and synthetic fuels. The defeated Germans sadly admitted that our operations produced these results. The independent U. S. Strategic Bombing Survey confirmed this to the hilt.

Bullseye Bombing

For such daylight precision bombing, the Boeing B-17 *Fortress* and Consolidated B-24 *Liberator* were developed along with the Norden bomb-sight, automatic controls, power-operated gun turrets, and more and more armor. It is readily admitted that, owing to winter-weather conditions

over Europe much of the bombing was far from "precision!" From early 1944, radar helped a lot.

By the end of 1942, AAF strength had passed the million mark, and it reached its peak of 2,375,000 by the end of 1943. The Air Training Command, the largest concordant educational effort in world history, was keeping up with the skyrocketing aircraft and engine production. In the period from Dec., 1941, through August of 1945, it was to graduate 193,240 pilots, 50,976 navigators, 47,354 bombardiers, 195,422 radio mechanics and operators, 51,357 radar mechanics, 347,236 gunners and 497,533 aircraft and engine mechanics. Such a production of trained technical personnel was unparalleled in the history of war. As much as the production of war equipment, this production of trained personnel, in such a short space of time, is a warning to belligerent Russia that what the United States has

done only recently, it can do again.

It is possible in brief space to do no more than indicate sketchily the part that the AAF played in the various theaters of war. Take Europe and North Africa first. From small beginnings, Allied air power in the Mediterranean achieved full strength by 1943, especially in heavy bombers. It spearheaded a long list of victories, including El Alamein, Tunisia, Pantelleria, Casablanca and Oran. In every campaign, it achieved air superiority over the enemy, cut off Tunisia from reinforcements, closely supported our ground troops there and later in Sicily and Southern Italy. It strafed 200 German bombers at Foggia and helped the Salerno beach-head to be established without much air opposition. During that battle it mustered more than 1000 sorties daily for two days in succession that helped to halt enemy counterattacks. It

(Continued on page 146)

Anywhere in the World Fall Wiper Rings

(Spring-Loaded with "Squeeze Grip Action")



Keep the Piston Tube Clean!

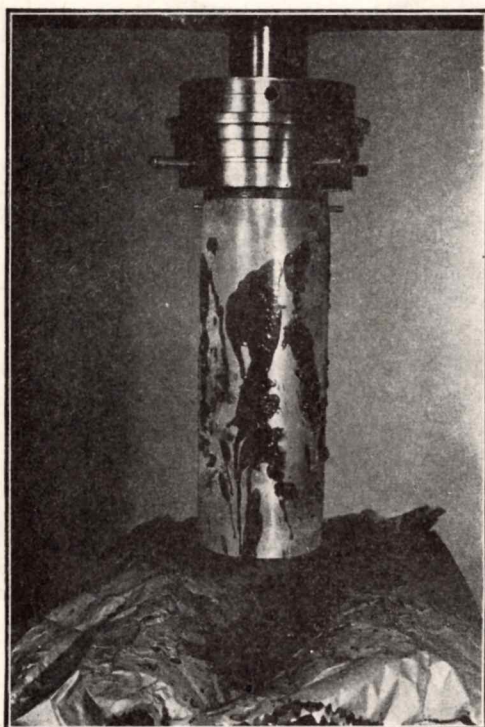


Fig. 1—Before

Unretouched photo of piston tube covered with ice and mud under 65° minus.

The following part numbers or sizes have been furnished by us for use on leading planes, bomb lifts, etc., to plane builders and manufacturers of landing gear shock struts and other hydraulic equipment:—

FWR-3C-3	5/8"	FWR-3C-27	2 3/4"	FWR-3C-43	4 3/4"
FWR-3C-5	3/4"	FWR-3C-28	2 7/8"	FWR-3C-45	5"
FWR-3C-6	13/16"	FWR-3C-29	3"	FWR-3C-47	5 1/4"
FWR-3C-9	1"	FWR-3C-30	3 1/8"	FWR-3C-48	5 3/8"
FWR-3C-11	1 1/8"	FWR-3C-31	3 1/4"	FWR-3C-49	5 1/2"
FWR-3C-13	1 1/4"	FWR-3C-33	3 1/2"	FWR-3C-53	6"
FWR-3C-15	1 3/8"	FWR-3C-35	3 3/4"	FWR-3C-54	6 1/4"
FWR-3C-18	1 5/8"	FWR-3C-36	3 7/8"	FWR-3C-55	6 1/2"
FWR-3C-21	2"	FWR-3C-37	4"	FWR-3C-56	6 3/4"
FWR-3C-22	2 1/8"	FWR-3C-40	4 3/8"	FWR-3C-60	7 3/4"
FWR-3C-25	2 1/2"	FWR-3C-41	4 1/2"	FWR-3C-62	8 1/2"

On Landing Gear, Bomb Lifts and/or Any Other Hydraulic Equipment . . . under High or Sub-zero Temperatures.

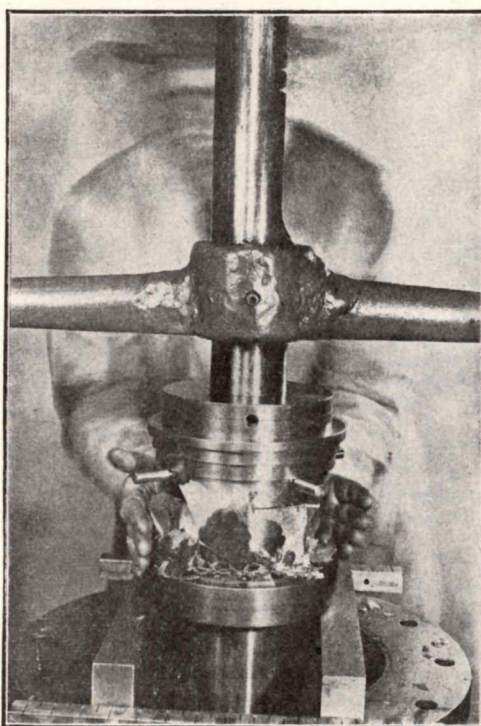
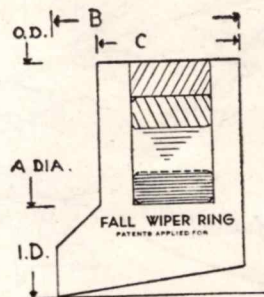


Fig. 2—After

Unretouched photo of same piston tube as in Fig. 1, with ice and mud being removed by the FALL Wiper Ring as Ring passes over the tube for the first time.



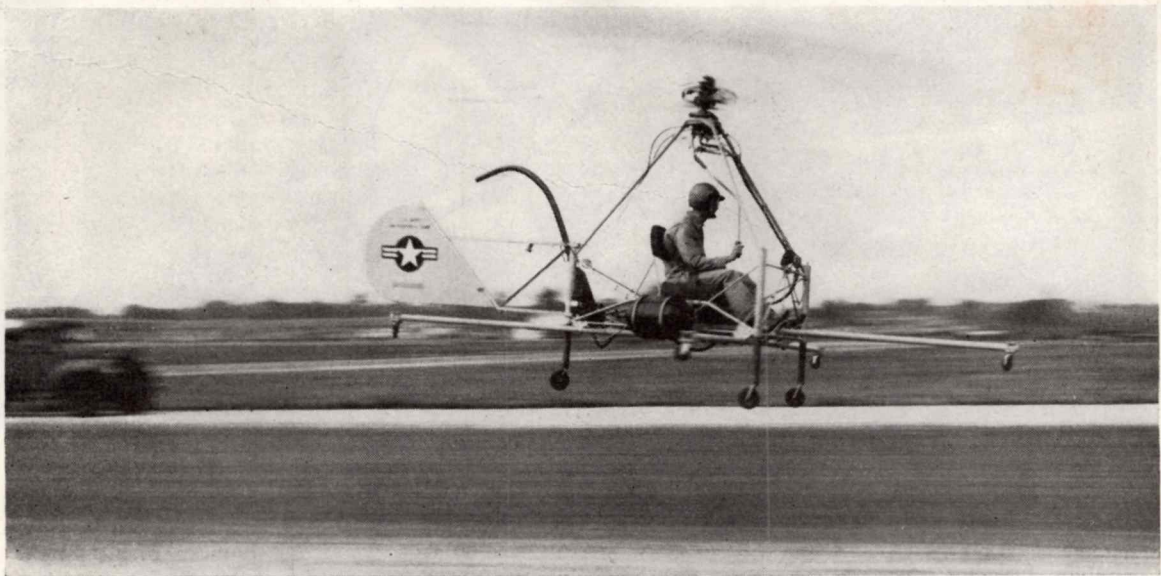
Cross-section of FALL Wiper Ring, "Spring-Loaded" with Squeeze Grip Action which occupies the same space used by AN-6231 Wiper Rings and which are manufactured under Spec. AN-6231 with respect to body material and dimensions and performance in accord with Spec. AN-S-60. Covered by Patents issued and patents pending.

• Fall "Spring-Loaded" Rings, designed with "Squeeze Grip" action, are applicable as Retaining Rings in a multitude of ways in modern machine design. The "Squeeze Grip" action makes the Fall Retaining Ring adaptable for use in larger diameters since it is shake proof . . . not affected by vibration.

FWR-3C-64 9 1/2"
FWR-3C-64P 9 3/4"
FWR-3C-65 10"

We manufacture any size Ring for Piston Tubes from 1/2" to 13" Diameter.

ACE PRODUCTS COMPANY, TOLEDO 1, OHIO, U.S.A.



First application of ramjet to helicopter is in the McDonnell-Air Force experimental "Little Henry"

HELICOPTERS in the AIR FORCE

COLONEL A. T. CULBERTSON

Chief, Cargo Branch, Engineering Division, Air Materiel Command

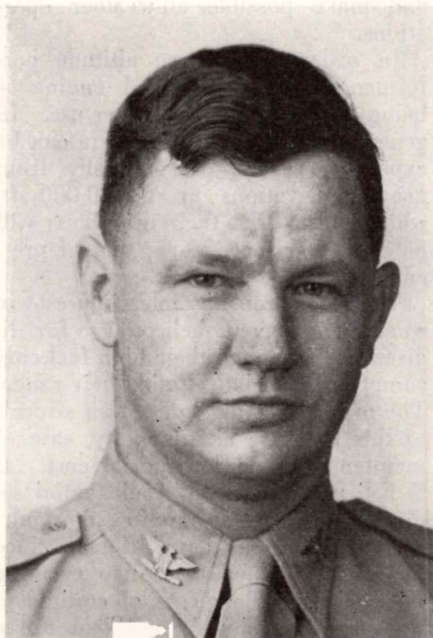
IT'S NO USE fighting windmills any longer, fellows; they're here to stay! A lot of engineers are dreaming up new ways of rotating wings horizontally, vertically, laterally, transversely and otherwise in varying combinations to do things that will put airplanes, and even the birds, to shame.

Those of you who would follow the old admonition to fly low and slow will do well to try it in helicopters rather than airplanes. And others of you who are jet-conscious won't be disappointed either, because helicopters lend themselves naturally to jet propulsion.

To get at the root of this rotary-wing business in the Air Force, we have to go back to 1921, when the Air Corps entered into a contract with George de Bothezat to construct and test-fly its first helicopter. The initial flight was made at McCook Field (the forerunner of Wright Field), Dayton, Ohio, on Dec. 18, 1922. While numerous flights were subsequently made with his aircraft, it was not an outstanding success. However, from that time until the present, the Air Force has continued to sponsor rotary-wing aircraft development, first in the autogyro and later in the helicopter. It is only lack of funds that prevents its venturing into convertiplane development and similar new fields.

The first military requirement for a

helicopter was as an observation aircraft having as its tactical mission the observation of artillery fire and liaison between tactical units and Command Posts. The first helicopter developed and delivered to the Air Corps with which any degree of success was achieved was the Sikorsky XR-4. Demonstration flights of this aircraft before various representatives of the



Col. A. T. Culbertson

Armed Services indicated that the helicopter had additional military value as a short-range liaison-type aircraft capable of operating off land or ship-board, for use with convoys, for coastal and harbor control, observation and fire control, ambulance duty, and air-sea rescue.

Helicopter development received considerable impetus during the war, and its present degree of success has been achieved as a result of wartime developmental funds which would otherwise have been unobtainable. By the end of the war, the R-4, -5 and -6 helicopters had been developed and used for many purposes. Some were employed in rescue missions behind enemy lines; others performed ship-to-shore transfer of maintenance parts, and still others were used successfully in such unpublicized roles as the breaking of ice jams, the calibration of radar equipment, fire control, geodetic surveying, photography and mapping, wire laying, and the transportation of pipeline equipment.

Although the original military use of helicopters was for liaison purposes, there are now four basic types of requirement for them:

The liaison type—a two-place aircraft designed principally for use by the Army Field Forces. These are normally selected from commercially available helicopters. At present, the Bell



R-13B is being procured for this purpose. This aircraft is the military version of the Bell Model 47, which has improved features, including refinements giving longer periods of operation between overhaul.

Rescue helicopters—required in two basic sizes: A small aircraft equipped with two or three litters, and a larger type accommodating six or more litters. These aircraft are required by the Air Force, Navy and Coast Guard for all types of rescue missions. Present aircraft used for rescue purposes are principally of the R-5 type, the latest being the R-5G, an improved version equipped with high-lift rotor blades, hoists and other improvements.

Cargo helicopters in light and medium classes are required for the transportation of all types of equipment and supplies into areas where other types of aircraft cannot operate. The XH-10* is the largest type presently available for cargo use and can carry in excess of 1200 pounds for approximately 300 miles.

Large cargo capacity, short-range, "flying crane" helicopters are needed for transporting supplies and equipment over obstacles such as hills and rivers to desired locations on both tactical and non-tactical missions, and to retrieve damaged equipment.

Since the helicopter can land and take off from a space having dimensions only a little greater than its own, there is practically no problem in providing operating bases. As the cruising speed of the small liaison helicopter is essentially the same as that of the present liaison type airplane, and its maneuverability is superior, it is conceivable that it may become practical to use helicopters entirely for liaison work. Further development of liaison types is continuing, with emphasis being placed on simplified design, improved reliability



Kellett XH-10 is latest development of large-type rescue helicopter for the Air Force; now undergoing engineering tests at Wright-Patterson AFB. Craft has useful load of pilot, attendant and four patients

and ease of maintenance, higher-altitude capacity, and improved inherent stability which will reduce pilot fatigue and make possible all-weather operations.

In order to improve altitude performance, a supercharged engine is being developed for helicopter use. In general, new liaison helicopters can be expected to take off vertically from ground elevations up to 10,000 ft, which means that their usefulness will be greatly enhanced over that of present machines.

There is considerable interest in small jet-powered helicopters for liaison use, although their high fuel consumption materially limits their range. The principal advantages of an aircraft of this type are its simplicity, ease of maintenance and low initial cost. It is believed that, with a substantial reduction in fuel consumption, these aircraft will become popular, and, since their cost is low, they may even be made expendable pieces of equipment for some uses by Army Field Force units.

Small rescue-type helicopters are used for short missions or where a small number of persons is involved. One of the requirements for these small helicopters is that they shall be readily transportable by cargo-type aircraft such as the C-82, so they can be flown to the airport nearest the scene of the rescue.

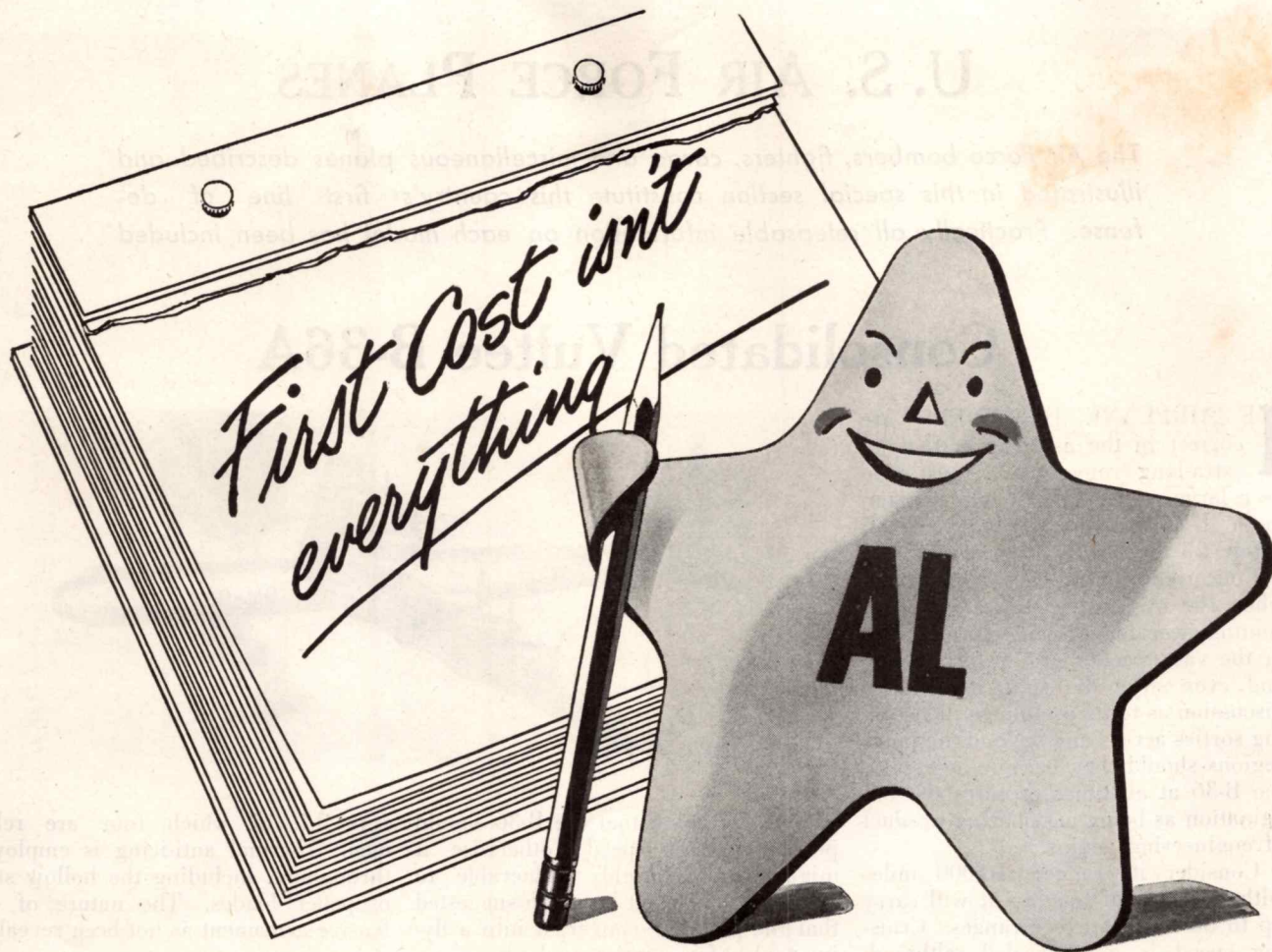
Where more persons or longer ranges are involved, the larger-type rescue helicopter is required. The latest development in aircraft of this sort is the XH-10, built by the Kellett Aircraft Corporation and having a gross weight of 11,300 pounds. Its useful load includes a pilot, attendant and four patients on litters. It has two 65-ft diameter rotors mounted side by side and intermeshed, and is powered by two radial engines of 525 hp each. This aircraft has successfully passed Government-acceptance flight tests and at present is undergoing further engineering tests at Wright-Patterson Air Force Base. The XH-16 helicopter, now being built by the Piasecki Helicopter Corporation for the Air Force and Navy, will provide much longer range and greater carrying capacity.

Expanding the Range

In an attempt to realize greater ranges in helicopter rescue operations without unduly increasing their size, numerous methods are being explored. Tests of helicopter towing are under way at Wright-Patterson Air Force Base, with the thought that the helicopter may be towed as an autogyro to the scene of an accident where it can be released for the actual rescue. Various types of auxiliary tanks and in-flight refueling techniques are being considered.

It is also possible in some of the newer types of helicopters to overload
(Continued on page 140)

* The "H" designation has recently replaced the "R" designation for helicopters in Air Force terminology.



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U. S. AIR FORCE PLANES

The Air Force bombers, fighters, cargo and miscellaneous planes described and illustrated in this special section constitute this country's first line of defense. Practically all releasable information on each model has been included

Consolidated Vultee B-36A

IF AIRPLANE DESIGNERS are correct in the assumption that an extra-long range plane must also be a large plane, then Convair's mammoth B-36 very-heavy bomber will surely fill the bill.

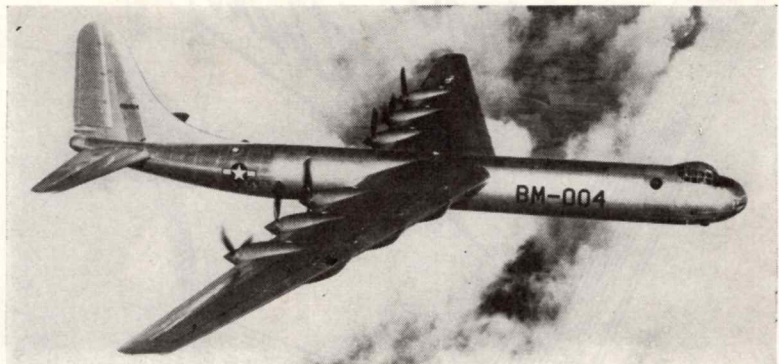
Conceived during the war years when the over-water strikes were becoming ever longer and more fearful in the vast reaches of the far Pacific, and ever since the subject of much discussion as to its usefulness in sweeping sorties across and beyond the polar regions should they become necessary, the B-36 at all times captures the imagination as being an amazing product of engineering genius.

Consider its range: 10,000 miles with five tons of bombs—it will carry up to 36 tons at lesser ranges. Cruising speed is not revealed, although its 300-plus *mph* top speed is considered too slow now. Service ceiling for this aerial giant is 40,000 *ft*.

Power is supplied by six Pratt & Whitney R-4360 3000-hp engines, mounted in pusher installations to make a laminar-flow wing possible. An increase in power is in prospect and there has been some recent speculation on the feasibility of changing to tractor installations. Propellers are three-bladed, reversible Curtiss Electric, 19 *ft* in diam. Fuel capacity is 21,116 *gal*, oil 1200 *gal*.

Wing span is 230 *ft*, length 163 *ft* and height 46 *ft* 7 *in*. During final assembly at Fort Worth, the nose of each bomber is raised considerably to lower the tail fin for clearance from bay to bay and through the factory door. Gross weight is 278,000 *lb*; landing gear is tricycle, with dual wheels for the nose gear and four-wheeled trucks for each main leg. The XB-36 has a single 110-*in* wheel on each main strut. Production models have eight 56-*in* main wheels to spread landing loads so that more runways can accommodate the bomber; there is also a 2600-*lb* weight-saving.

The Air Force contract calls for 95 B-36A's. Rumors of a cutback have met with denials by those directly concerned although expensive modifications may reduce the total. However, appraisals of their future usefulness

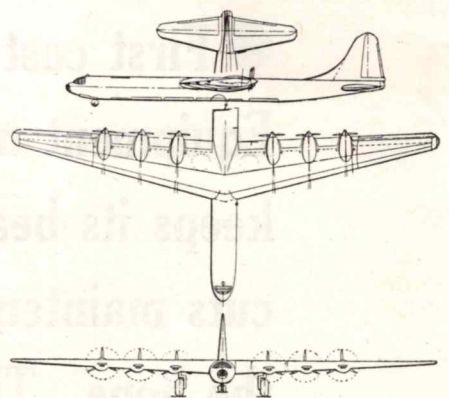


lean to the belief that the B-36 should possess greater speed; otherwise it might become highly vulnerable to enemy attackers. It has been suggested that the plane be converted into a flying tanker for aviation fuel.

The B-36 might also become the "aircraft carrier" of the USAF if present tests with the McDonnell XF-85 parasite jet fighter prove fruitful. This small plane is designed to be launched from the bomb bay of the B-36 in flight and to be retrieved after its mission has been accomplished. The parasite would be refueled, rearmed and receive limited repairs aboard the "mother" plane.

Four bomb bays have a volume of 12,300 *cu ft*; crew compartments fore and aft are pressurized and connected by an 85-*ft* tunnel. The crew num-

bers 14, of which four are relief men. Thermal anti-icing is employed throughout, including the hollow steel propeller blades. The nature of defensive armament as not been revealed.



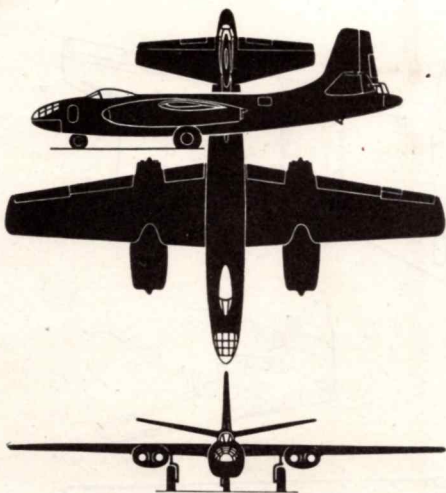
North American B-45A,C

NORTH AMERICAN AVIATION claims the distinction of having developed the world's first operational multi-jet bomber to go into production. Its clean-lined B-45 holds this honor, and the plane is a good one.

Post-war advances in airpower are well illustrated in the B-45. It is technically classified as a medium bomber—yet it has a design gross weight of 82,600 *lb*, a normal tactical radius exceeding 800 miles, and will carry a bomb load of better than 10 tons. By contrast, World War II "heavies" were lighter, carried somewhat less tonnage

and cruised little better than half the speed, although their ultimate range was superior. The war-time "mediums" were much smaller than the B-45; although fast, they had considerably less speed and carried fewer bombs over a shorter range.

Four General Electric-Allison J-35 (TG-180) axial-flow gas turbines, with 4000-*lb*. thrust each, power the bomber. They are arranged in pairs in single nacelles on each wing and placed ahead of the leading edge which makes for ease of accessibility. Although the



Air Force officially states that the B-45 is capable of speeds in excess of 480 *mph*, it is practically certain that this aircraft will top the 500-*mph* mark and have some to spare. Service ceiling is 40,000 *ft*. Advanced models in the B-45 series are expected to switch to the General Electric TG-190 (J-47A) with 5000 *lb* thrust, which will improve performance.

It has the sleek lines of a jet fighter



and is entirely free of exterior gun turrets and other protruding equipment. Pilot and copilot sit in tandem inside a bubble canopy not unlike that of a fighter plane. Two other men complete the operational crew of four.

Wing span is 89½ *ft*, length 74 *ft* and height 25 *ft*. The landing gear and flaps are operated hydraulically; trim tabs are actuated electrically. Hydraulic boost is provided for the main flight

controls.

Production began on the B-45 at North American's Long Beach plant late in 1947. The Air Force has placed an order for 96 "A's" and 94 "C's." The "C" is a modification of the "A," the nature of which has not been released. Armament installations are classified. Latest announcements state that some B-45s will go to the Air National Guard.

Northrop B-49

IN ITS quest for long range bombardment aircraft the Air Force has not been content to stick to conventional types. Experimental orders were placed during the war years for several XB-35 Northrop *Flying Wing* bombers, propelled by four *Wasp Major* engines in pusher installations, driving counter-rotating propellers.

This 100-ton bomber was a true all-wing aircraft—no tail or separate fuselage—for which designer John Northrop had been trying to gain acceptance even before the war. The unorthodox XB-35 was planned for a range of 10,000 miles. Its proponents claimed that, when compared with aircraft designed for similar purposes and identical power, the *Flying Wing* would excel by 25% in speed, load-carrying ability and range.

That the engineering was basically sound was proved at once when the prototype took to the air. Test pilots reported excellent handling characteristics and unusual stability. There was one fly in the ointment—the counter-rotating propellers proved persistent troublemakers, delaying flight operations for weeks at a time. Present models will fly with single-rotation propellers, at some sacrifice in speed and



altitude, until improved contraprops are available.

A natural evolution after the war transformed the *Flying Wing* into the sleek, high-performance YB-49. The inevitable jet engine made it possible to remove practically all surface protruberances, making it look like a giant boomerang. The only "fins" showing are four vertical air separators for directional stability.

Eight General Electric TG-180 (J-35) turbojets, developing 4000 *lb* of thrust apiece, are installed in groups of four on each wing. Under certain conditions, each *lb* of thrust in a jet engine equals one *hp*. Thus, Northrop is justified in saying that its heavy bomber is the most powerful plane in the world.

Like its propeller-driven predecessor,

the B-49 spans 172 *ft*, is 53 *ft* 1 *in* long and stands 15 *ft* high; root chord is 37½ *ft* and tip chord 9 *ft*. Weight empty is 88,100 *lb*, gross more than 200,000 *lb*.

As for performance, all information beyond the divulgence of a service ceiling in excess of 30,000 *ft* is restricted. Unofficial reports indicate, however, that the jet-propelled YB-49 is a superb performer and that no serious modifications seem necessary. Unfortunately, the first one built crashed mysteriously and was destroyed during a routine flight out of Muroc Air Base, with no technical observer witnessing the mishap to report the probable cause.

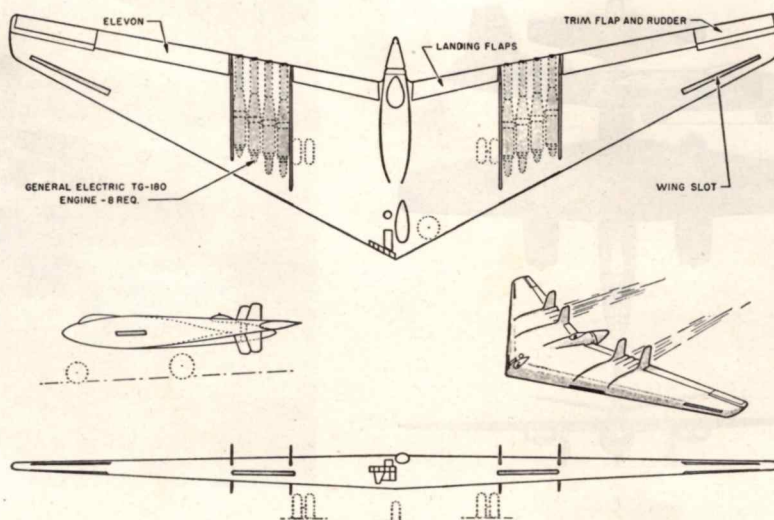
Northrop-designed "elevons" are placed on the trailing edges of the outer wing panels to perform the functions

of elevators and ailerons; trim flap-rudder assemblies are installed at each wing-tip. Landing flaps occupy the trailing edge of the large center section, and slots in the wing-tip leading edges aid in control at slow speeds.

These large flight controls are actuated through a hydraulic booster system, coordinated with pneumatic loading devices to provide an artificial "feel" to the pilot's control, similar to that obtained naturally in a smaller aircraft. Special electrically-operated throttles prevent over-acceleration of the eight jet engines. Throttles can only be opened slowly, to extend engine life by holding down tail-pipe temperatures.

A crew of 13 is specified; six relief men are included. Armament has not been disclosed. Fully-retractable tri-cycle gear with dual main wheels and a single nose wheel is employed.

In addition to three experimental B-35's, 10 production models of the propeller-driven *Flying Wing* are being built. Compounded Pratt & Whitney R-4360 engines, with General Electric variable-discharge turbines, will be installed for an approximate 20% in-

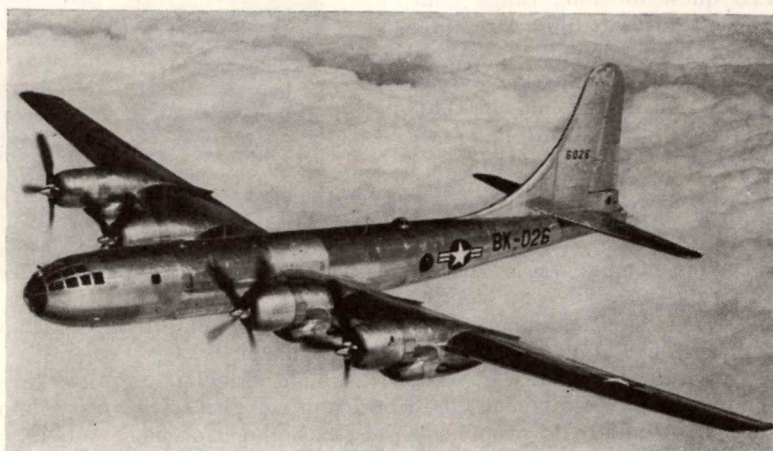
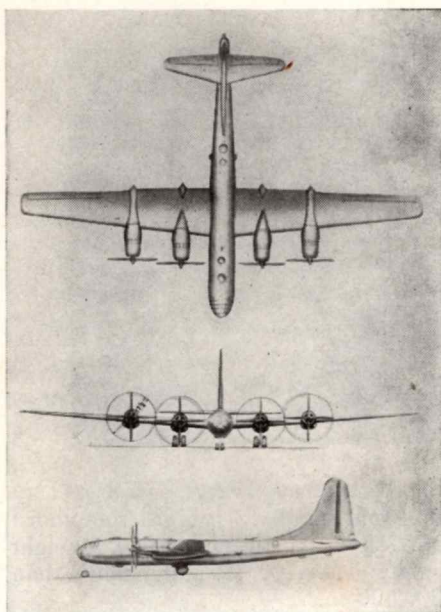


crease in cruising range. Initially, two YB-49 heavy-bombardment aircraft were ordered. With the passage of the expanded air-power program, Northrop received an order for an additional 30 B-49's, which the company claims are equally adaptable for cargo or transport use.

Another use may well be for long-

range reconnaissance flights. At any rate, the Air Force seems to be in a hurry to make the B-49 operational. With the overcrowding of Northrop's West Coast manufacturing facilities presenting a bottleneck, steps have been taken to build *Flying Wings* in the tremendous aircraft plant of Consolidated Vultee at Fort Worth.

Boeing B-50 Series



THE Boeing B-50 *Superfortress* is the standard long-range bomber of the Air Force. Outwardly resembling the more familiar B-29, it is a new design by at least 75%, cruises 27% faster at equal range, has newer and stronger (though lighter) wings and a fast-acting landing gear.

Initial production began with the B-50A, a total of 215 being ordered. The B-50B is basically the same plane, with similar performance and a stronger wing; the B-50C has an improved powerplant providing increased

performance. Information on the powerplant and other installations on this plane is still largely classified, although it is known that the engines are compounded Pratt & Whitney R-4360's, with General Electric variable-discharge turbines. Compounding is expected to bring an approximate 20% increase in cruising range. The B-50D is a modified "B" with about the same performance; the modifications, which are military in nature, are classified. About 40 B-50B's have been delivered to Sept. 1st.

New orders for 132 B-50D's and

30 B-50C's brought to 377 the number of bombers of this series built by or under contract to Boeing.

It has been reported that owing to substantial differences between the B-50C and others in the B-50 series it has been redesignated as the B-54. For some general details on its new powerplant (R-4360 VDT) see article *Compound Engine* (p. 65).

The *Superfort* is powered by four 3500-hp Pratt & Whitney R-4360 engines, turning Curtiss Electric four-bladed, reversible propellers measuring

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SEPTEMBER 1948

17 ft 2 in in diameter. Engine nacelles are fully interchangeable and each contains a General Electric turbosupercharger, intercooler and the other engine accessories.

Maximum speed approaches 400 mph; cruising is 300 mph. The service ceiling exceeds 35,000 ft and cruising range is 5000 miles with a 5-ton payload. Recent improvements and practice flying in using the latest Air Force cruise-control methods have dem-

onstrated a surprising range with a larger bomb load. (See *Shrinking the World*, page 31).

Wing span is 141 ft 2 in, length 99 ft and height 32 ft 9 in. The vertical tail section folds horizontally for passage into the average hangar and for full access to empennage controls. Normal gross weight is 120,000 lb. Extensive use of 75-S aluminum alloy has been made throughout structural members; thermal anti-icing is employed.

An unusual serviceability note is struck by the interchangeability of wings, tail, landing gear and other main accessories with the Boeing C-97A *Strato-freighter*, transport team mate of the *Superfortress*.

Known armament consists of 13 .50-caliber machine guns mounted in five turrets, tied in with an improved General Electric remote fire-control system like that on the B-29. Full operation calls for a crew of 11.

Lockheed F-80C

THE *Shooting Star* won the distinction of being the first U. S. jet plane slated for operational use. Although a little too late for World War II, it has since been produced in greater number than any other jet-propelled aircraft in the world and is the best known to the man on the street.

Lockheed says the F-80 is "the most modern operational jet fighter in the world"—and that claim can probably be made to stick at this time in spite of terrific competition by other comers being groomed in the Air Force, Navy and British stables. It will take some doing for any design, no matter how well modified, to remain in the lead (even operationally) within the near future.

More than 1000 F-80's were built during the past three years. An order for 457 F-80C's was placed in early June. The new F-80C is a 600-mph fighter powered by a newer Allison turbojet, the J-33-23, which has a take-off rating of 4600 lb of thrust. Performance figures have not been released, but if specifications of the slower, less powerful F-80B are consulted, it becomes apparent that the new "C" is a pretty able scrapper.

Service ceiling is 46,000 ft; normal cruising range better than 1500 miles, possibly close to 2000 miles; gross weight 14,000 lb; empty weight 8000 lb; wing span 38 ft 10½ in; length 34 ft 6 in; height 11 ft 4 in. Rate of climb has not been revealed, but an F-80 has been climbed 15,000 ft straight up after a dive.

The chief modification of the F-80C is its more powerful J-33 turbojet, the Model 400 developed by Allison which powered the *Shooting Star* that brought the world speed record back to the U. S. at 623.8 mph, exceeded since only by special research aircraft. Water-methanol injection will provide bursts of thrust 20% to 25% above normal for emergency use. Jet-assisted take-offs are accomplished with two 1000-

lb thrust JATO units attached under the fuselage.

The F-80C is equipped with six .50-cal machine guns in the nose, which have an increased rate of firepower over the M3's used during the war. These have passed rigid Air Force tests. As a long-range escort, the plane will carry six guns and ammunition, and wing-tip fuel tanks that increase the operating range as much as 70%.

As a fighter-bomber, the F-80 carries six machine guns, ammunition and a 1000-lb bomb at each wing tip in place of extra fuel tanks. As a rocket-carrying fighter, it will launch 10 five-in, high-velocity rockets from racks slung underneath the wing. The photo-reconnaissance version mounts aerial cameras in the nose, which photograph 100 square miles at 40,000 ft.

F-80's feature an extremely high rate of aileron roll, executed without movement of the elevator or rudder, for a quick, straight-ahead 360° roll with full visibility for the pilot. The air-frame design features simplicity and ease of servicing for maintenance operations.

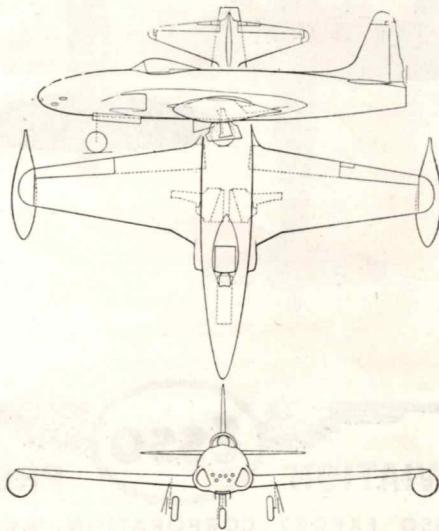
Fuselage-type dive brakes, a pilot-ejection seat and cockpit refrigeration and pressurization are standard.

Shooting Stars are in tactical service with Air Force groups in the U. S., Alaska, Okinawa and Japan. A group of 75 F-80's, formerly assigned to the Panama Canal Zone, was transferred to Germany, while 16 others were flown on a special mission across the North Atlantic by way of Labrador, Greenland, Iceland, Scotland and Eng-

land. The flight was designed to test the feasibility of ferrying jet-propelled combat aircraft over the route, and to explore the logistical and operational problems involved. (See full story, *F-80's Across*, p. 34). About mid-August the 16 F-80's left Germany for Scotland for the first leg of their return to the U. S. by the same route.

Air National Guard units are beginning to receive *Shooting Stars*, and may eventually get 3000 of them.

The new orders for F-80C fighters, together with orders for TF-80C two-place trainers, are expected to keep the production lines busy until middle 1950. At present, one plane is completed per day by a work force of 12,000 employees.





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Know your Air Force better. Visit exhibits at Air Force Bases on Air Force Day, September 18, 1948.



BOEING

Republic F-84A

WHEN Republic's first *Thunderjet* rocketed across the sky it at once drew the admiration of ground spectators. Here is a pencil-slim jet fighter which has been consistently billed by its designers as capable of 600 mph, and better. Events proved that the F-84 engineering team had used inspired slide rules.

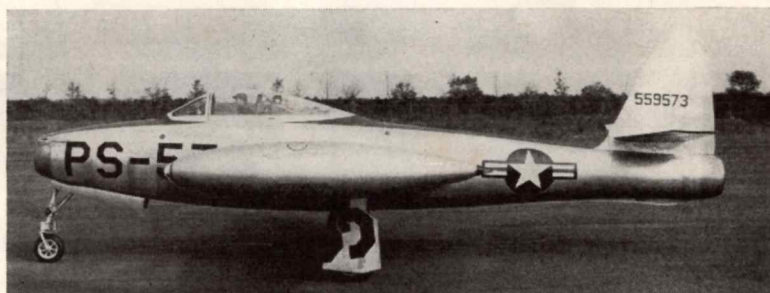
The 84 had to measure up to extremely stiff competition from the very beginning; the Lockheed *Shooting Star* had already captured the imagination of a nation by a dazzling, jet-propelled performance, then new to the world. Air Force gave Republic Aviation Corp. an opportunity to create another fighter to match the one Lockheed was building, surely mindful of those tough and dependable P-47's and P-38's which worked side-by-side in effectively devastating the aggressor during the last war.

The F-84 and F-80 are much the same in physical dimensions, in weight, and each has a straight wing with some dihedral. Here resemblance ends. Republic engineers put the air intake for the jet engine into the very nose of the plane, dividing the inflow through two ducts which curve around the legs of the pilot and converge again to deliver directly into the front of the engine.

The powerplant is General Electric's TG-180, an axial-flow design which was later turned over to Allison and designated the J-35, and which has since become the most widely used American turbojet engine. It is rated at 4000-lb static thrust. If afterburning can be successfully incorporated, the thrust will most likely be upped to 5000 lb. The whole installation is such that combustion air entering through the nose of the plane has almost a "straight through" passage to the exit of the jet tail cone. This configuration plays no small part in producing such enviable performance as the F-84 fighters have chalked up.

This gas turbine is now being built by Allison as the J-35-A-15, which powers the latest *Thunderjet*, the F-84C. Advanced models of the plane are in development and will in all probability be fitted with the General Electric TG-190 (J-47), which in many respects is an improved TG-180 with a "dry" thrust rating of 5000 lb.

The *Thunderjet* has a service ceiling of 40,000 ft, plus; normal cruising range around 1200 miles; wing span

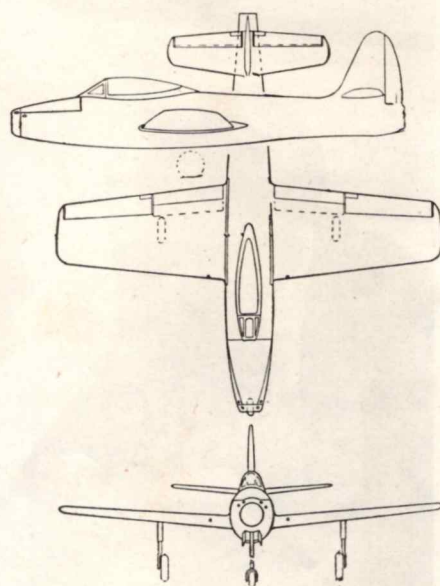


36 ft 5 in; length 37 ft 2 in; height 12 ft 10 in; gross weight 13,000 lb; empty weight 9000 lb. Wing-tip fuel tanks provide increased range. The cockpit is pressurized and has automatic air conditioning. Like the F-80, it has a pilot-ejection seat and a full-vision bubble canopy.

Both wing and tail airfoil sections of the F-84 are designed to almost the same formula for low drag as those on Republic's four-engine XR-12 *Rainbow*. The maneuverability of the *Thunderjet* at all speeds and altitudes is increased by an automatic adjusting, booster aileron-control system, which varies force according to the air speed of the plane.

Normal operational armament consists of six new model .50-cal machine guns. Fire power has recently been greatly augmented by the addition of eight 140-lb, high-velocity aircraft rockets, carried four under each wing panel. The F-84 successfully passed rocket-firing tests flying at speeds up to 500 mph. Retracting mounts disappear into the wing as the rockets are launched, again reducing the number of drag-producing attachments. The guns are also concealed internally to reduce flight friction.

In addition to the well-publicized 14th Fighter Group at Dow Field, Me., and the 20th Fighter Group, Shaw AF Base, Sumter, S. C., both completely equipped with *Thunderjets*, the 33rd



Fighter Group, Walker AF Base, Roswell, N. M., is receiving deliveries now. At least two other groups are scheduled to be equipped with F-84's during 1948.

Approximately 300 have been delivered; orders for another 300 under early contracts remain to be filled. Under the recent appropriations for 1949, 409 F-84C's have been ordered from Republic. All-in-all an impressive number of one make of fighter for a peacetime air force!

North American F-86A, C

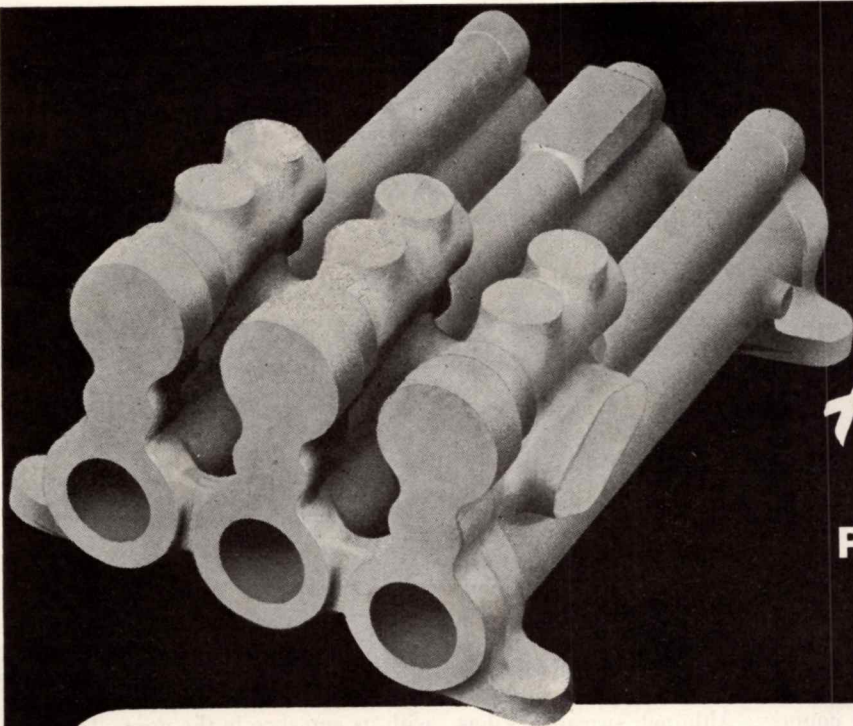
NORTH AMERICAN AVIATION received a lion's share in dollar value from the current procurement list. The largest single item was for 451 additional swept-wing F-86 A fighters, which brought the company's orders on this plane to 674.

North American's P-51 *Mustang* won undying fame as a fast and hardy stinger in battle, a worthy partner in the celebrated triumvirate which included the Lockheed P-38 and Republic P-47. The F-86 is a fit partner in the new Air Force trio encompassing the F-80, F-84 and F-86. In fact it

bids fair to steal the show from the other two, which are already operational, by phenomenal performance.

The F-86A went into production before tests had been completed on the prototype, an indication of product worth and faith in the maker's ability to deliver. Actually, the F-86 is an operational airplane designed for speeds greater than the present official world's speed record of 650.796 mph, captured by special research aircraft.

Speed is written all over the design; super-thin, swept-back wing and empennage present a rakish appear-



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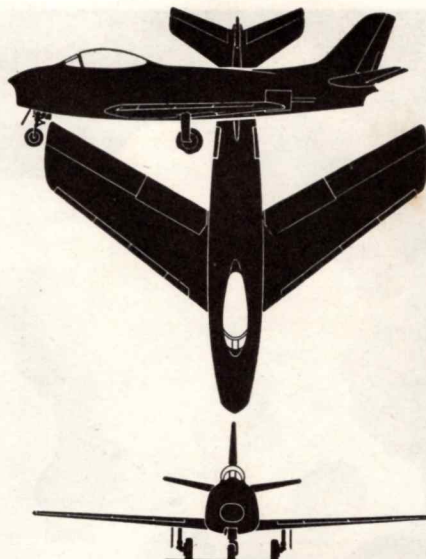
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ance which is heightened by the long, slim fuselage. The wing presented a major design problem which was solved by sandwich construction in which structural material is laminated between inner and outer tapered skins. All exterior surfaces are extra-finished to reduce drag to a minimum.

Power is supplied by the most powerful U. S. turbojet in production. Actually, the first production model test flight of the F-86A marked the initial test flight for the new General Electric J-47A (TG-190A) jet engine. This axial-flow gas turbine has a rated thrust of 5000 *lb*, which will be boosted to 6000 *lb* or better, if and when water-injection or afterburning prove practical.

The F-86 has a normal tactical radius of 500 miles and service ceiling in excess of 40,000 *ft*. Gross weight

is 13,715 *lb*. Wing span is 37 *ft*; length 37 *ft*; height 14 *ft*. Wing sweep back is at an angle of 35°. A conventional tricycle landing gear is used—retracted hydraulically.

This plane will be the first with sweptback wings to fly operationally in this country. Although sweep-back has long been used on numerous aircraft, its employment here is for the express purpose of delaying the formation of compressibility shock waves. The arrowhead planform is expected to "fit" more or less into shock-wave patterns.

All the talk about speed is not wishful thinking by any means. The XF-86, which had a J-35 (TG-180) engine, exceeded 650 *mph* in straight and level flight. Furthermore, it has been unofficially reported that the same plane passed the speed of sound (*Mach* 1.0) in a dive. The exact speed cannot be

determined since the altitude of the plane at the time is not revealed.

The F-86 employs a single, straight-through ram duct for combustion air, with its entrance in the nose. This type of ducting is used by North American also on its Navy carrier-based fighter, the FJ-1 *Fury*. The F-86 has a pressurized and air-conditioned cockpit and a pilot-ejection seat. Its bubble canopy is faired smoothly into the whole sleek design. The plane's tactical effectiveness is abetted by the latest radio, radar and navigational aids.

The Air Force ordered 554 F-86A and 120 F-86C fighters. The difference between the two has not been announced. Also, details on armament have not been released.

Curtiss-Wright F-87

FOR brute size and sheer bulk, the Curtiss-Wright F-87 airplane may well be the largest fighter ever produced. This all-weather aircraft has a wing span of 60 *ft*, is 65 *ft* long and stands 20 *ft* high. As to weight, official announcements state only that it "weighs almost as much as the *Flying Fortress* of World War II." This means that the gross weight must be in the neighborhood of 40,000 *lb*, or better. It will be called *Blackhawk*.

The "X" model is powered by four Westinghouse axial-flow 24C engines, arranged in pairs in a single nacelle on each wing. Each powerplant produces 3000-*lb* thrust, for a total of 12,000 *lb* for the plane. Production models, however, have been redesigned to receive two General Electric-Allison J-33 centrifugal-flow engines. These are



rated at 4600 *lb* of thrust each—which can be boosted considerably by use of water injection, and by an after-burner which may be fitted to an advanced version of the J-33.

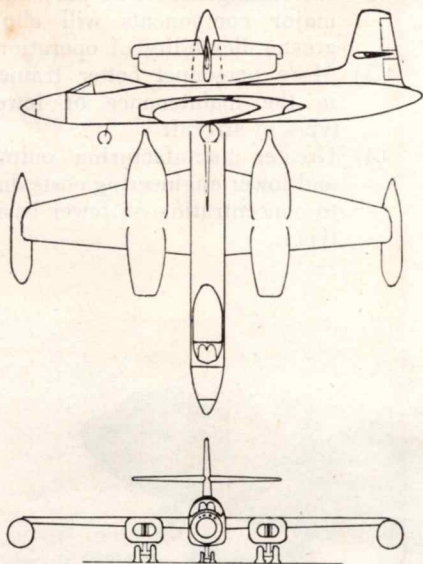
In the prototype, the jet-power units were located aft of the main wing structure to lessen the danger of engine fires to the plane and to afford

a maximum of access for service and maintenance work. The newer design, utilizing two instead of four engines, has not yet been made public.

Not only is the F-87 impressive in dimension; it is also designed to give a good account of itself when it comes to speed. It is rated in the 600-*mph* class and has a service ceiling some-

where above 35,000 ft.

Up to this point, the Air Force has had no long-range, jet-propelled fighter to keep pace with its wider-ranging and ever-faster heavy bombers. The F-87 should at least come close to



being the answer to this problem; although official figures throw little light on the matter, stating merely that cruising range is more than 1500 miles.

The new Curtiss fighter is designed for all-weather operation, incorporating the latest in navigational and safety equipment for that purpose. Included are the newest in anti-icing devices.

Unusual for fighter aircraft is the side-by-side seating of the two-man crew, permitting flight operations with maximum efficiency. A bubble canopy provides complete visibility for both men. It is a mid-wing design with a straight, thin wing and tail surfaces placed high to avoid the blast of the jet powerplants. A long, tapering dorsal fin completes the aerodynamic structure.

The tricycle landing gear is equipped with dual wheels on the main- and nose-gear legs. Jettisonable auxiliary fuel tanks may be carried, one on each wing-tip.

Curtiss-Wright received an Air Force order for 58 F-87 twin-jet all-weather fighters and 30 RF-87A photo-reconnaissance versions. Even before the deal became official, the company received a contract authorizing \$1,500,000 for tooling, materials and engineering to equip the Columbus, Ohio, plant.

Curtiss has produced numerous fighter types for the Armed Forces during the past three decades. Progress in flight is dramatically illustrated by a comparison of the big, new F-87 with the company's first one, the S-3; a triplane with a wing span of 25 ft, weighing 1300 lb and powered by a 100-hp engine.

Boeing C-97A

BOEING AIRPLANE CO. received the highest dollar value in contracts of any manufacturer in the aircraft industry. In midsummer, its total backlog (military and commercial) amounted to \$300,000,000. Some new orders under the air-power expansion program are still in process of negotiation.

Included in this total is an Air Force order for 27 C-97A *Stratofreighters*, costing \$33,393,000. One of Boeing's first post-war orders was for six production line YC-97's, with the same wing, empennage, powerplant and landing gear as used by the B-29.

The strategy here was to create a transport for military purposes which could carry a real load, cruise as fast as the bombers it was supporting and enjoy the full significance of interchangeability as applied to major aircraft components. Thus, the long-range YC-97 transport and the B-29 long-range bomber became a "team."

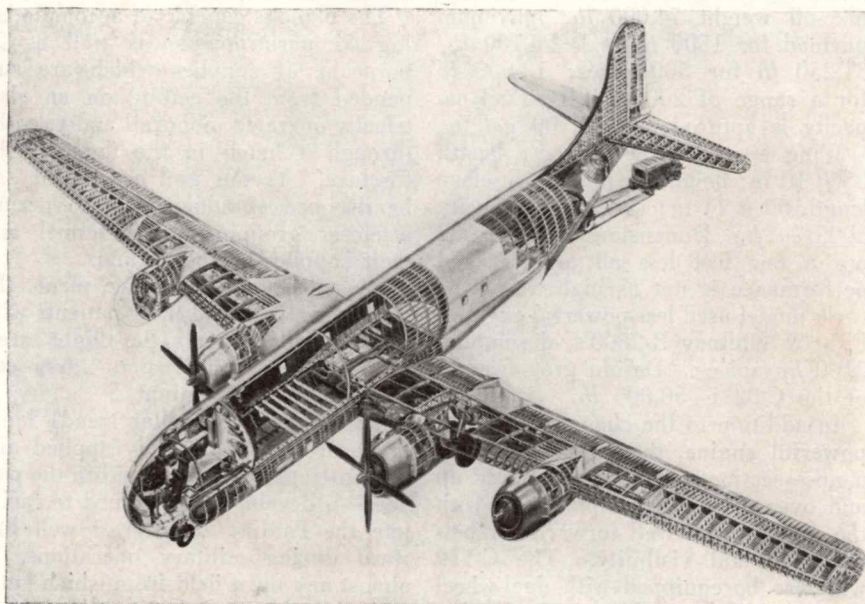
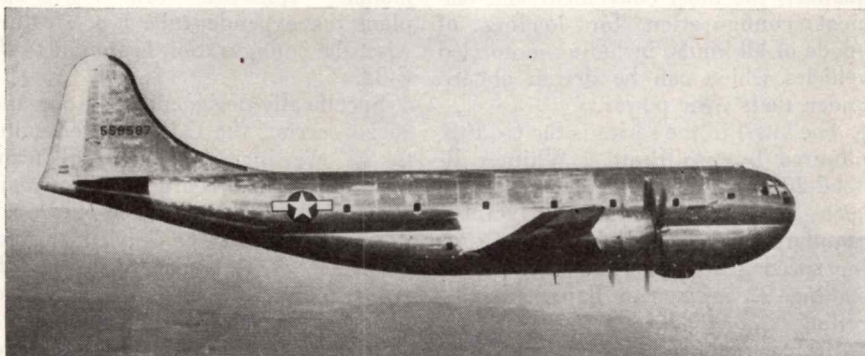
Just as soon as the newer B-50 *Superfortress* began to supersede the obsolescent B-29, Boeing improved the YC-97A over its predecessor to keep

the cargo plane up to newer requirements. The AF order for 27 *Stratofreighters*, together with airline orders for approximately 55 *Stratocruisers*, should eventually serve to make the figure-8 fuselage, with a long, graceful upsweep toward the tail cone, a familiar sight wherever large transports are flown.

The C-97A spans 141 ft 3 in, is 110 ft 4 in long and 38 ft 3 in high. Power is supplied by four Pratt & Whitney 3500-hp *Wasp Major* engines driving Curtiss Electric, four-bladed, reversible propellers. Empty weight is 72,865 lb; gross weight 130,000 lb; fuel capacity is 7715 gal.

Maximum speed is around 375 mph; cruising 340 mph; service ceiling 30,000 ft; and cruising range 4700 miles. It will carry 41,000 lb of payload, or 134 fully-equipped troops, or 83 litter patients with medical attendants and supplies. The entire fuselage is pressurized and the temperature controlled. A crew of five is required.

The interior is divided into two decks. The lower one is made up of two cargo compartments which are



reached through doors set at the height of motor-truck beds for fast transfer of cargo. The upper deck extends virtually the full length behind the crew compartment and will take single articles up to 61 ft long. Large clamshell doors at the rear, underneath the tail, make it possible to transfer cargo directly from ground transportation into the interior.

A self-contained power-winch mono-rail system for loading and unloading is installed; automatic aerial delivery via parachute is also provided. Self-contained ramps make it possible to

drive vehicles, tanks or other mobile armament directly inside for fast delivery to strategic points.

Effective military operations of the future call for quick air strikes—fly in, establish an advanced base and begin bombing the enemy. With range, speed and altitude characteristics roughly the same, a transport-and-bomber combination operates as a team, each supplementing the other. The transport can go where the bomber can go; fuel required is of the same grade; oils, greases and servicing devices are applicable to both craft.

With the full utilization of the Boeing type of standardization, the following benefits may well be realized:

- (1) Fewer different parts for bases to stock
- (2) Interchangeability of parts and major components will allow greater flexibility of operations
- (3) More personnel better trained in the maintenance of fewer types of aircraft
- (4) Greater manufacturing output and lower engineering costs due to concentration on fewer basic types.

Fairchild C-119B

EVER since the end of the war, Fairchild Aircraft has been producing and furthering its line of *Packets*, nicknamed the "flying box-cars." The C-82 was designed as a simon-pure cargo airplane; its cavernous fuselage has a rectangular shape which can spell out only one answer—the most convenient and efficient configuration for loading of goods of all kinds, including motorized vehicles which can be driven aboard under their own power.

The latest in the series is the C-119B, powered by two Pratt & Whitney R-4360-20 engines—take-off hp 3250 each—driving three-bladed Hamilton Standard reversible propellers. Cruising speed is 231 mph at 10,000 ft and stalling 92 mph with flaps. Service ceiling is 23,900 ft.

Basic weight is 37,230 lb; design gross weight 64,000 lb; maximum take-off weight 74,000 lb; maximum payload for 1500 miles is 24,100 lb; 31,250 lb for 500 miles; 18,000 lb for a range of 2000 miles. Fuel capacity is approximately 2700 gal.

Wing span is 109 ft 3 in; length 85 ft 10 in; height 26 ft 7 in; fuselage length 60 ft 11 in; and cargo capacity 3095 cu ft. Dimensions of the C-82 are a few feet less all around, and performance is not as high, since the early model used less-powerful engines, Pratt & Whitney R-2800's, developing 2100 hp apiece. Design gross weight of the C-82 is 50,000 lb.

In addition to the change to a more powerful engine, the C-119B features a nose section which tapers gently up and over the flight compartment, with the pilots seated well forward for better all-around visibility. The C-119 will also be equipped with dual-wheel landing gear carried on a single oleo



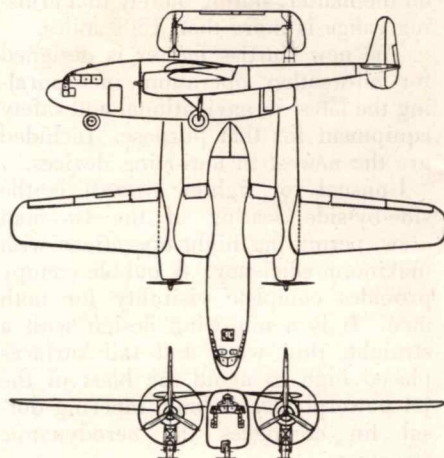
strut under each wing, instead of the single-wheel design used on the earlier model. "Roto-disc" brakes will supplant the expander-tube type. Otherwise, the configuration is similar to the C-82.

Specifically designed as a troop-and-cargo carrier, the C-119 is well suited to its ever-increasing role of transporting whole airborne divisions and all their equipment and supplies. Military freight can be loaded through clamshell doors which open up the entire rear of the cargo hold. Truck bed-level loading here and at a smaller side door at the forward end adds operational efficiency.

The plane is capable of accommodating 42 paratroopers, as well as 20 paracans of supplies which are suspended from the ceiling on an electrically operated monorail and released through a hatch in the floor of the fuselage. Troops and equipment can be dropped simultaneously to permit a closer grouping of personnel and their supplies on the ground.

Rigged as an ambulance plane, the *Packet* can carry 38 litter patients with four attendants and the flight crew of five. Strap-suspension litters can be installed in 20 minutes.

Track-type (caterpillar tread) landing gear was successfully applied and demonstrated on a C-82 within the past year—a development planned to facilitate the landing of aircraft well forward during military operations, in almost any open field from which landing obstacles and humps have been

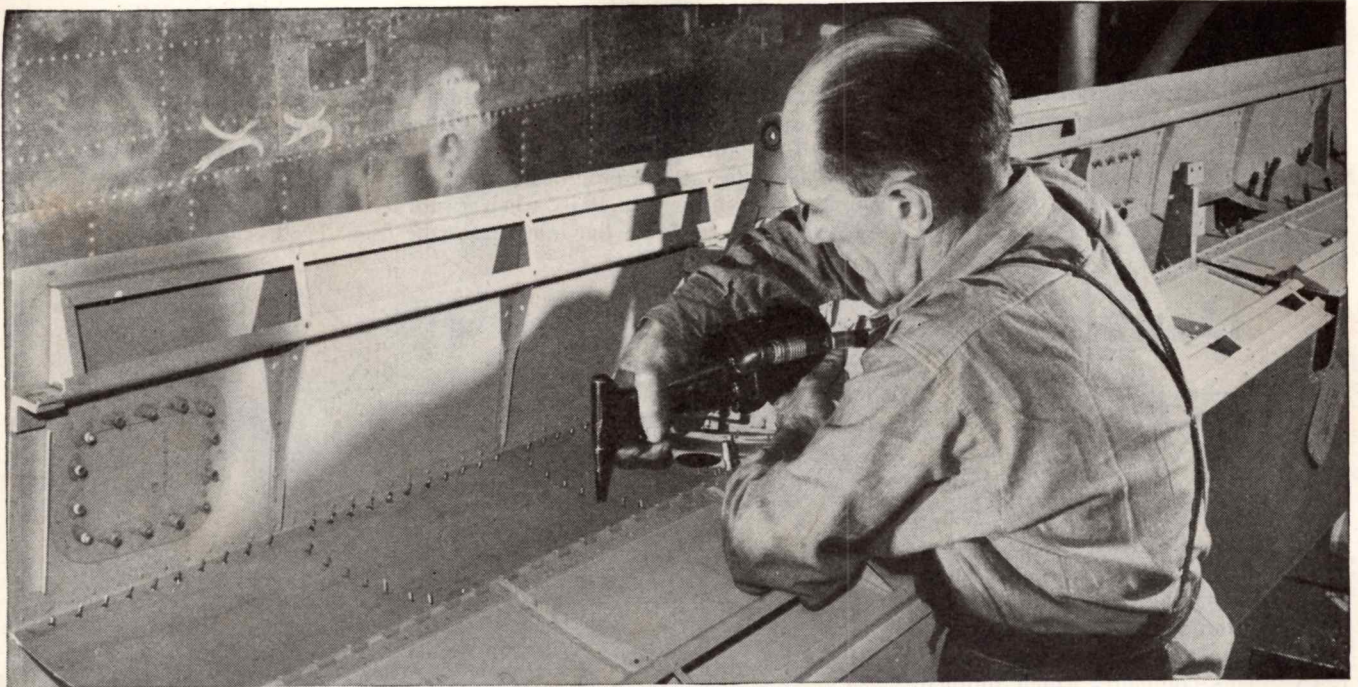


cleared (perhaps by a light bulldozer parachuted from the *Packet* in the first place). Eighteen C-82's now in operation with the Ninth Air Force, Greenville (S.C.) Air Base, will be equipped with complete tricycle installations of track-tread gear. Five additional sets will be manufactured as spares. Retractable skis also proved successful.

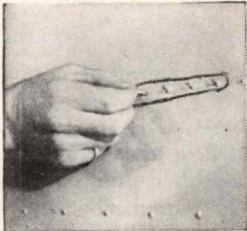
More than 150 *Packets* have been delivered to the Air Force, practically all assigned to troop carrier squadrons of the Ninth Air Force, and are seeing extensive service.

Vehicles loaded are ready for maneuvers as soon as they roll from the plane. The practicability of dropping bulky equipment, such as artillery pieces, jeeps and bulldozers, by parachute is being explored.

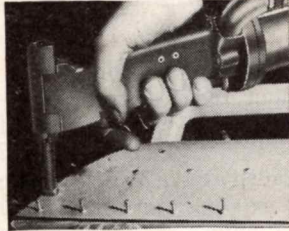
The C-82 and its capabilities have been demonstrated before troops at



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overseas bases in Europe and Japan. Cold-weather exercises were held in the U. S. and Alaska and mass jumps of paratroopers have been made out of its rear doors in practice maneuvers in the Southern states. The *Packet* is equipped to tow two standard military gliders with personnel or equipment.

Fairchild Aircraft has repeatedly is-

sued literature describing how the "flying boxcar" would fit into the air-cargo picture for peace-time pursuits. However, the Air Force cast a possessive eye upon the design and has absorbed all production up to this time. The closest Fairchild came to commercial flying was in 1946, when a C-82 was used to make the inaugural

flight of five-cent air mail across the country. Special post-office equipment was installed in the interior and clerks sorted mail en route.

More than 150 C-82's are in service; 20 were ordered in the fiscal year 1948, also an initial 37 C-119's. An order for 99 C-119B's was received under the fiscal 1949 procurement program.

Douglas C-124A

DOUGLAS AIRCRAFT received a contract under the new procurement program for immediate production of 28 large all-purpose transports, designated as the C-124A. This company, which fulfilled contracts for literally thousands of transports during the war, has since manufactured little for the Air Force, with the exception of a dozen C-74 *Globemasters*, which design was also being groomed as a potential long-haul passenger airliner.

The C-124A is two and one-half times the size of the ubiquitous C-54; has a design gross weight of 175,000 lb. Its designers claim, however, that despite the great difference in size, the C-124A will operate from the same modest fields the *Skymaster* uses.

Emphasis is completely on "strategic" air transport for military support and supply. It possesses the ability to carry large payloads for a distance equal to the range of heavy bombers. At the maximum payload of 50,000

lb, the plane will transport cargo 1200 miles and return to base without refueling. Lesser loads can be moved over greater distances.

Its design provides for the transport of heavy ground equipment, supply vehicles and artillery. With a built-in nose ramp, first in production in the U. S., loading and unloading of heavy vehicles is accomplished through large clamshell doors leading into the maw of the immense interior, much like an airborne counterpart of the sea-going LST's of the last war. An electric elevator and loading well

amidships add to the speed of cargo transfer.

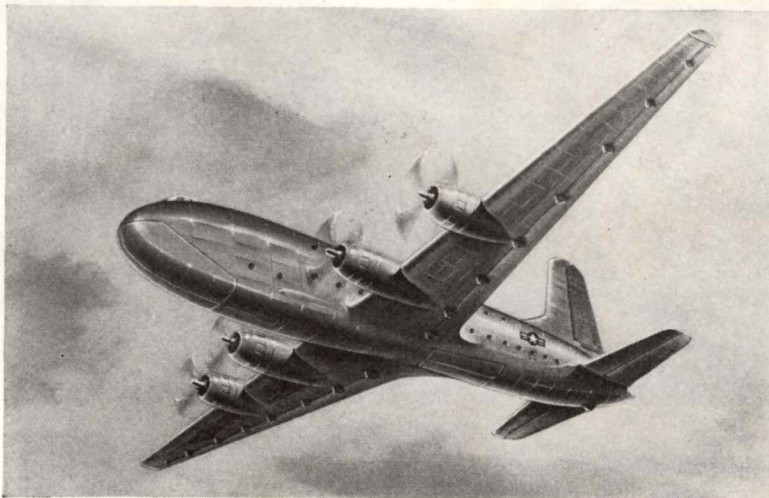
Wing span of the C-124A is 173 ft 3 in, length 127 ft 2 in and height 48 ft 3 in. Like its modified predecessor, the C-74, which measured about the same but grossed only 145,000 lb, the new transport is powered by four Pratt & Whitney R-4360-49 engines. With water injection they provide 3500 take-off hp each. Hamilton Standard four bladed, reversible propellers, 16½ ft in diameter, are installed.

Actually, the design of the C-124A was developed from that of the C-74 *Globemaster*. It utilized the wing, empennage, powerplants and other service-proven components of that transport. The unmistakable stamp of Douglas engineering is evident all over the plane, from the large tapered wing and rounded fuselage—of greater girth than usual in the fore section—to the typical tail surfaces, made known far and wide by the DC-4 and the DC-6.

The forward cargo door is 11 ft 8 in high and 11 ft 4 in wide. Access is provided to a 10,000 cu ft interior, 77 ft long, 13 ft wide and 12 ft 10 in high.

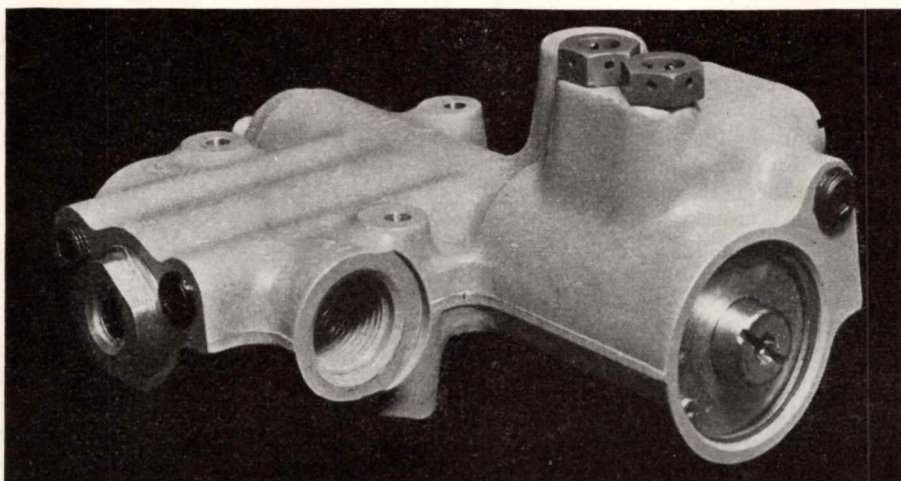
As a personnel carrier, the huge interior may be converted into a double-deck cabin transport, carrying 222 troops and their field equipment. When used as a hospital plane, it will transport 123 litter patients, 45 ambulatory cases and 15 attendants.

The C-124A comes as the latest of a series of well-liked four-engine Doug-





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las transports. The C-54 spanned 117½ ft, had 1450-hp engines, grossed 62,000 lb with a useful load of around 24,000 lb and cruised around 240 mph. The XC-112 (DC-6) is about the same size but grosses 71,000 lb for the same

useful load; its powerplants develop 2100 hp each and cruising speed exceeds 316 mph.

The C-74 spans 173 ft, originally used a 3000-hp engine, grossed 145,000 lb with a 60,000-lb useful load and

cruised about 265 mph. By comparison, the C-124A transports a payload of 50,000 lb or better. Performance details have not been released. The 28 units ordered by the Air Force will cost \$95,000,000.

North American T-28

NORTH AMERICAN AVIATION won an industry-wide design competition for the Air Force's new all-purpose training plane, to be used in preparing pilots for the step into high-speed jet aircraft. The design award carried with it a contract for production of 268 of the trainers, designated T-28.

The two-place all-metal trainer will be used for both primary and basic flight instruction. It is more or less conventional in design, except for its retractable tricycle landing gear, claimed to be the first for use on a trainer of this type in the U. S.

It is powered by a Wright R-1300 engine with a take-off rating of 800 hp. Top speed is 292 mph and the service ceiling 31,650 ft—performance considerably better than that of the company's wartime trainers. Normal gross weight is 5862 lb, about 600 lb heavier than the AT-6 *Texan* which it supersedes.

North American engineers won a design competition for trainers as early as 1935 and 1936, with the NA-16, a two-place, open-cockpit, low-wing model which was fabric-covered. This became the BT-9 with a closed canopy, of which 95 were produced in 1936 after the company had moved to California from Baltimore. Design evolution brought on the BT-14, the BC-1 and BC-2 and the better known AT-6.

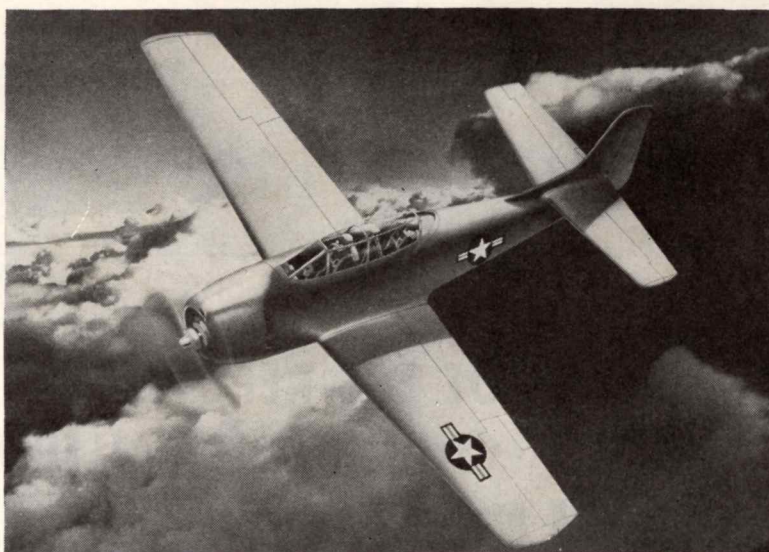
The AT-6 *Texan* was produced by the thousands as the advanced trainer of World War II, including those built as the SNJ for Navy pilot training and those delivered to Allied air forces all over the world, such as the *Harvard* for the Canadians and British.

This progression was powered by engines producing from 400 to 600

hp; the same basic pattern was employed, although metal came to be used to a greater degree in each succeeding model and improved navigational devices and better propellers were installed down through the years.

Thus, the T-28 has a worldwide reputation to uphold, and will probably do so quite ably. It has the traditional North American wing and fuselage configuration, surmounted by a full-vision canopy over both cockpits. Its dimensions have not been given, but they approximate those of the AT-6, which had a wingspan of 42 ft and was 29 ft long.

Ease of accessibility has been stressed for efficient maintenance, to reduce both the personnel and time required to keep the plane in flight status.

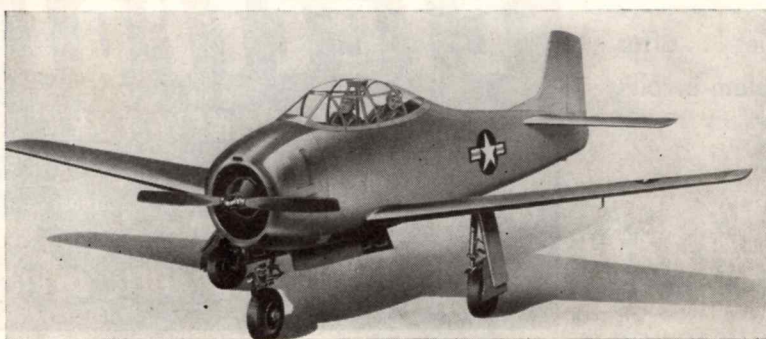


Lockheed TF-80C

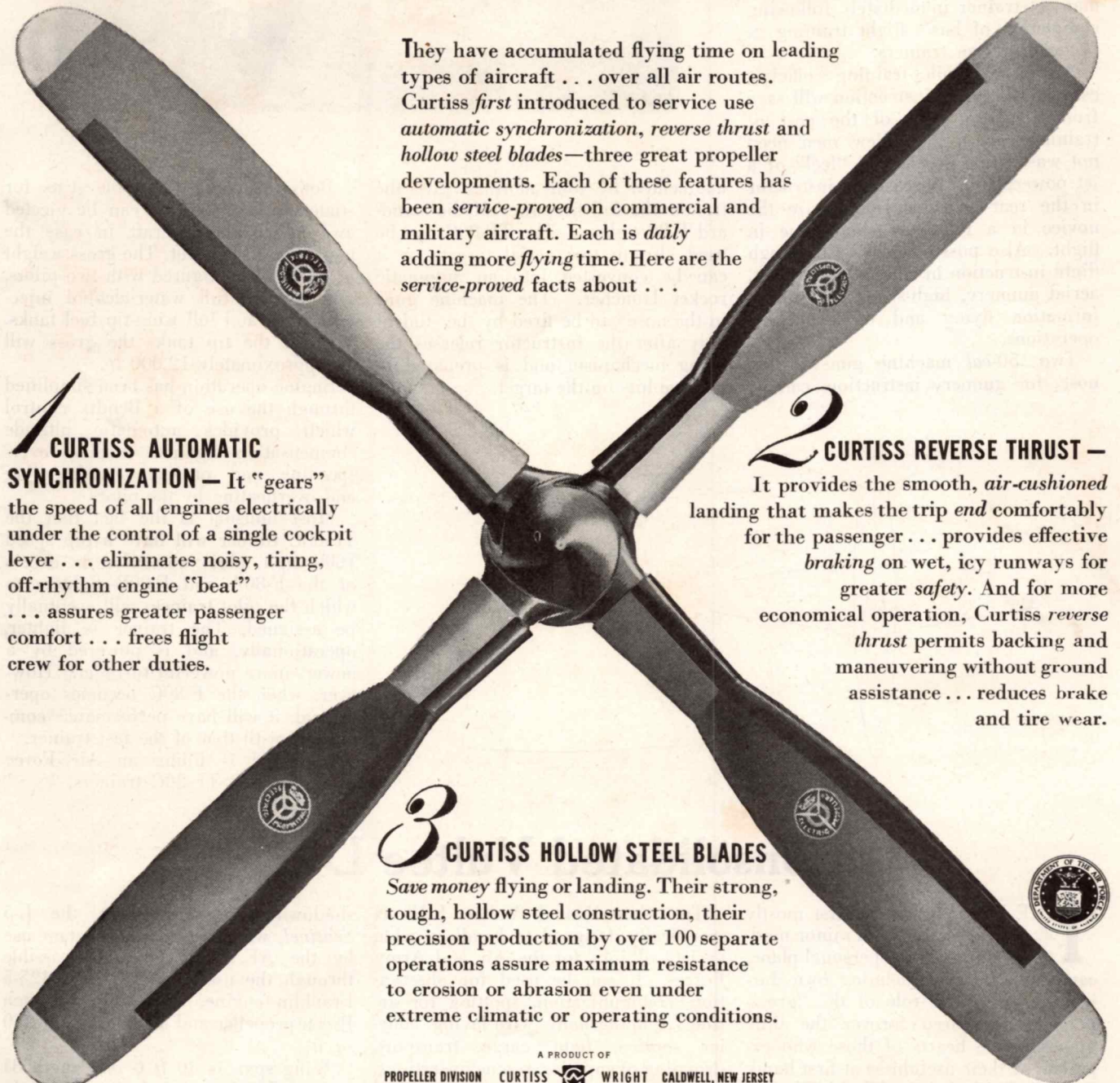
THE Lockheed-AF TF-80C *Shooting Star* is America's first jet-propelled trainer built specifically for the job. That job is to accelerate the development of Air Force pilots who will blaze across the skies in near-sonic jet fighters or shepherd new jet-powered bombers at ever-increasing speeds, unheard of a few years back.

A two-man cockpit is provided in the TF-80C. This was accomplished by increasing the fuselage length by 3 ft and installing a 7-ft cockpit canopy; the engine is the same Allison 400 (J-33-23) installed in the F-80C, developing 4600-lb thrust; and a larger air conditioning and refrigeration system is used. Otherwise the trainer is a standard F-80B fighter. In fact, the prototype was built from a standard F-80B taken off the assembly line.

The remaining trainers will be built on a special production line. Empty



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1 CURTISS AUTOMATIC SYNCHRONIZATION — It “gears” the speed of all engines electrically under the control of a single cockpit lever . . . eliminates noisy, tiring, off-rhythm engine “beat” . . . assures greater passenger comfort . . . frees flight crew for other duties.

2 CURTISS REVERSE THRUST — It provides the smooth, *air-cushioned* landing that makes the trip *end* comfortably for the passenger . . . provides effective *braking* on wet, icy runways for greater *safety*. And for more economical operation, Curtiss *reverse thrust* permits backing and maneuvering without ground assistance . . . reduces brake and tire wear.

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weight is approximately 8000 *lb* and gross weight 14,000 *lb*. Flight controls, throttles, brakes, landing gear lever and the emergency hydraulic lever are inter-connected between the two cockpits. The instructor in the rear seat can switch off the student's electrical controls leading to critical control items.

Use of the jet trainer is planned to eliminate one step in normal fighter-pilot training—transition flying in high-performance conventional aircraft—before trainees can be sent up alone in a single-seater jet plane. New student pilots will be put into the two-man jet trainer immediately following completion of basic flight training in propeller-driven trainers.

Air Force pilot-training officials estimate that dual instruction will save from 10% to 15% of the cost of training each pilot. New men need not waste time getting the “feel” of a jet powerplant. A seasoned instructor in the rear seat can familiarize the novice in a relatively short time in flight. Also possible will be thorough flight instruction in combat maneuvers, aerial gunnery, high-speed navigation, formation flying and other tactical operations.

Two .50-cal machine guns in the nose, for gunnery instruction, can be

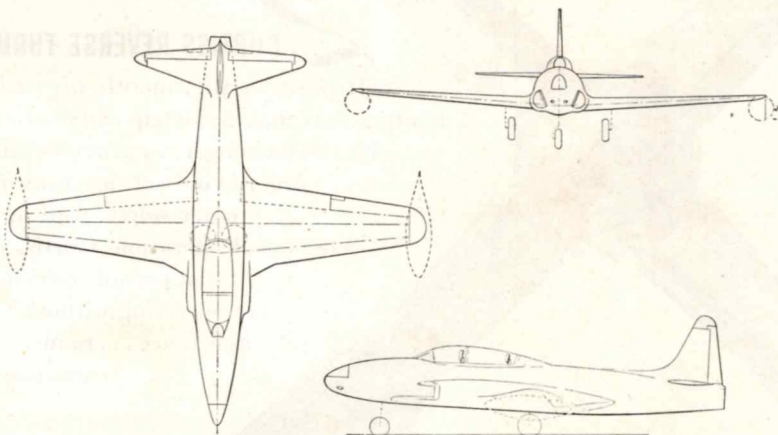
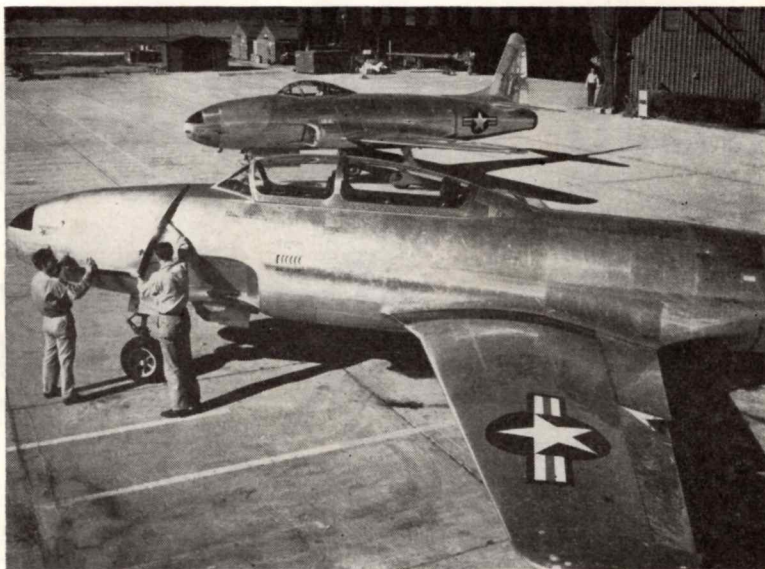
augmented by four more to give the trainer the full firepower of the standard F-80 fighter. The TF-80C can be used also to tow aerial targets or it can be converted into an automatic rocket launcher. The machine guns in the nose can be fired by the student only after the instructor releases the firing mechanism and is prepared to observe hits on the target.

Both the canopy and the seats for student and instructor can be ejected away from the aircraft in case the men have to bail out. The gross weight of 14,000 *lb* is figured with two pilots, ammunition, full water-alcohol injection tanks and full wing-tip fuel tanks. Without the tip tanks the gross will be approximately 12,000 *lb*.

Engine operation has been simplified through the use of a Bendix control which provides automatic altitude compensation against turbine overspeeding and prevents manhandling and overheating by the pilot.

Most unusual is the fact that the TF-80C trainer will have a top speed (600 *mph*, plus) somewhat in excess of the F-80A and F-80B fighters to which the pilot trainees will eventually be assigned. The trainer is lighter, operationally, and is powered by a newer, more powerful turbojet. However, when the F-80C becomes operational, it will have performance comparable with that of the fast trainer.

Lockheed is filling an Air Force order for 128 TF-80C trainers.



Consolidated Vultee L-13

THE liaison plane, at first mostly an adaptation with minor modifications of the personal plane, came into its overwhelming own during the war. The role of the “grasshoppers” endeared forever the little planes to the hearts of those who experienced their usefulness at first hand. Full credit for their World War II employment must go to several sage lightplane manufacturers who saw their worth and kept promoting the idea until their products were given an opportunity to show what they could do.

The Consolidated Vultee L-13 is specifically designed to handle a wide variety of jobs for the Air and Army Forces. It can be used for observation, communication, spotting for artillery, photography, wire laying, courier service, light cargo transport, dropping of supplies, rescue operations, special radio and ambulance purposes. Air Force Rescue Service detachments are being supplied with this aerial jack-of-all-trades.

Angular and sturdy, the L-13 turns in an exceptional performance — over-

shadowing its predecessor, the L-5 *Sentinel*, which is still in constant use by the AF. This is made possible through the use of a 245-hp, O-425-5 Franklin engine, large, variable-pitch Beech propeller and a wing area of 270 *sq ft*.

Wing span is 40 *ft* 6 *in*; length 31 *ft* 9 *in*; height 8 *ft* 5 *in*; gross weight 2900 *lb*; useful load 1012 *lb*. Maximum speed is 115 *mph*; cruising 92 *mph*; service ceiling is 15,000 *ft*; range 368 miles with normal fuel capacity of 46 *gal*. Landing speed is 43 *mph*;



landing distance 227 ft (482 ft over 50-ft obstacle); take-off distance 230 ft (470 ft over 50-ft obstacle).

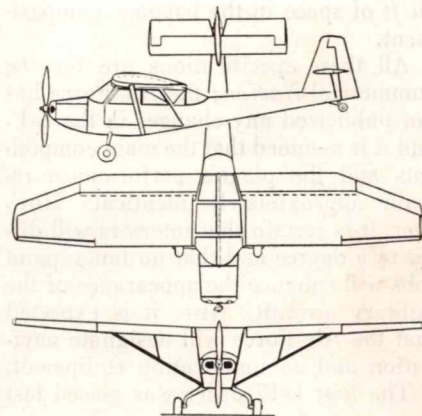
The normal crew is three, although the plane will carry an overload of six in an emergency. When used as an ambulance plane, two litter patients and two crew members are accommodated. Litters are readily transferred by opening the two doors on the right side and removing the center door post. Wire-laying containers and cargo containers for drop purposes are fastened underneath the wing.

Most exceptional feature of the L-13 is the folding of the two wing panels, back and alongside the fuselage, with trailing edges up. The horizontal stabilizer and elevator fold upward for wing clearance and the whole plane thus shrinks to a mere 80 in in width. The main landing gear wheels, with a tread of 92.5 in for flight operations, can be rotated into position inside the

struts to narrow the tread down to 61.6 in.

The purpose of these special features is to facilitate ground hauling and towing by truck or jeep over ordinary roads. The "folded" L-13 fits inside a standard military truck body. It is also possible to hide the plane readily in the woods or brush with wings folded.

About 20 of the 146 on order will be winterized for operation in sub-zero temperatures and will be known as the L-13B. The chief changes are: (1) form-fitting covers provided to protect wing and tail surfaces while plane is moored in the open; (2) combustion heater and ducting installed; (3) cabin walls, floors and doors insulated; (4) cold-weather lubricants applied; (5) modifications in heat and air vents; (6) special instrumentation and engine temperature controls; (7) wing tips and empennage painted red to



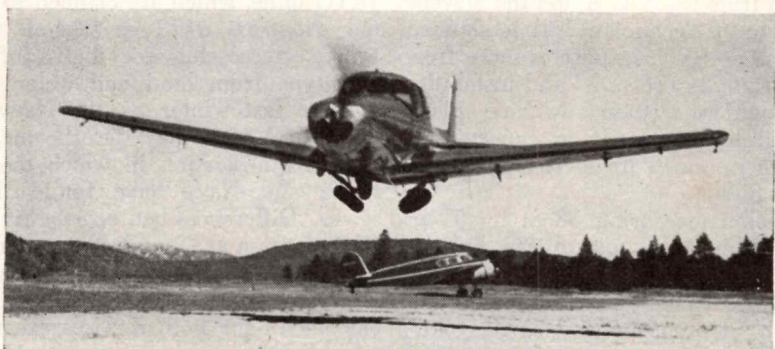
aid search crews in case of a forced landing in snowy territory.

Skis can be quickly installed to replace the wheels or the gear can be replaced with floats. Dual controls are provided, with the right-hand set removable.

As with all new designs, the L-13 revealed some "bugs" in its makeup. Along with minor refinements—and afterthought improvements—the brakes have been enlarged and a tail wheel designed to eliminate shimmy. Of greater concern is some engine vibration trouble. This however is expected to be cleared up soon and the plane put back into service.

The L-13 was engineered by Convair's Stinson division; production takes place in San Diego. Liaison and Rescue personnel are working with it at March Field, Calif.

Ryan L-17A, B



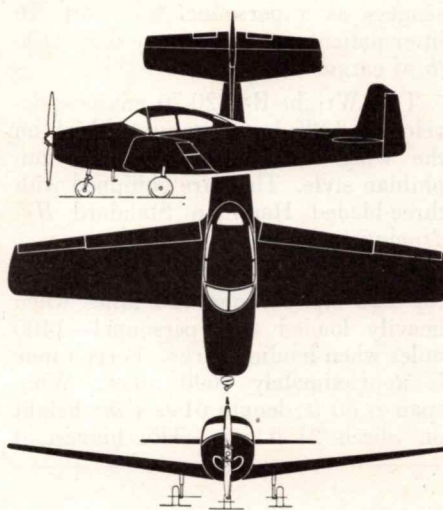
RYAN AERONAUTICAL CO. has received an Air Force contract for 153 *Navions*, designated the L-17B. This is the first AF production order for Ryan since the war. Last year the Air Force purchased 83 L-17A *Navions* from North American Aviation, when the four-place plane was produced by that company.

The L-17B is referred to as an "all-service" plane; in this case the Air Force is serving as procurement agent

for the Army Field Forces and the National Guard. The \$2,500,000 contract also calls for spares which in dollar value represent approximately 60 complete *Navions*.

Wing span of the *Navion* is 33 ft 4½ in; length 27 ft 3 in; height 8 ft 6 in; empty weight 1680 lb; gross weight 2750 lb.

Maximum speed is 157 mph; cruising 150 mph; service ceiling 15,600 ft; range 500 miles; rate of climb 830



fpm; fuel capacity 39½ gal. It is powered by a Continental 185-hp engine and can be equipped with either a Hartzel or *Aeromatic* variable-pitch propeller. Normally, it carries four passengers and has an additional 20

cu ft of space in the baggage compartment.

All these specifications are for the commercial *Navion*; the Air Force has not publicized any changes in the L-17 and it is assumed that the main components and the plane's performance remain approximately identical. However, it is certain that interiors will differ to a degree and that no fancy paint jobs will enhance the appearance of the military aircraft. Also, it is expected that the Air Force will designate navigation and communication equipment.

The first L-17 order was placed last

year when the Air Force and Army opened a competition for four-place liaison planes to be used for reconnaissance, personnel and cargo carrying, light transport operations, courier service, general communication and a variety of utility work where the operation of multi-engined aircraft proved uneconomical.

A basic requirement for the plane is that it be able to operate in and out of small, rough (often unimproved) fields and display a general ruggedness and versatility. Ryan's *Navion*, as one of the best known executive planes in

this country, has met this requirement fully during daily business pursuits. It is often taken off and landed far from the beaten track by owners with interests distant from smooth landing fields.

Deliveries of the L-17B will begin in late summer and be completed by the end of 1948. Approximately one-third are scheduled for use by the Army Field Forces. Somewhat more than another third will go to occupation forces—half going to Europe and half to Asia—and the remainder will be distributed to National Guard bases.

Grumman SA-16A

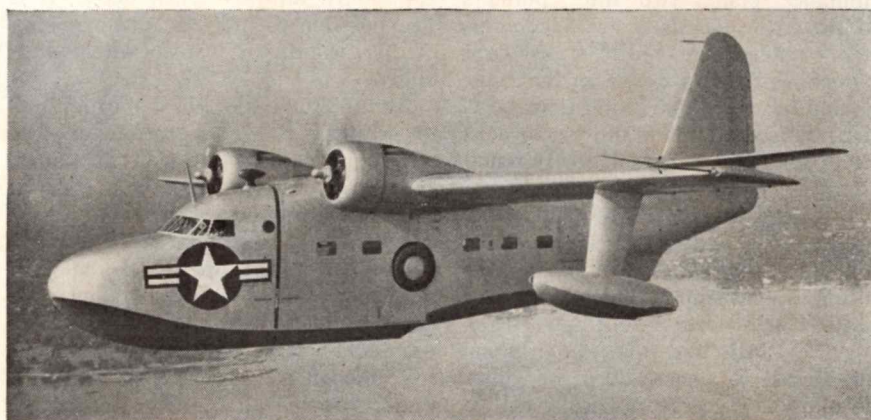
GRUMMAN AIRCRAFT, which has long been a Navy mainstay for top-notch fighters and torpedo bombers, has received a sizable Air Force contract in the form of an order for 32 SA-16A *Albatross*.

This twin-engined amphibian was originally announced by the Navy during December 1947. The prototype was designated the XJR2F and was planned for rough-water operations on the open sea, such as rescue work, personnel or cargo transport or multi-engine seaplane training. The Air Force version is scheduled predominantly for rescue operations, perhaps in view of the greater frequency of over-water operations now becoming necessary by Air Force planes.

The *Albatross* carries a crew of three, pilot, co-pilot and navigator-attendant. It will accommodate 14 passengers as a personnel transport, 16 litter patients, or carry more than 4100 lb of cargo.

Two Wright R-1820-76 engines, developing 1425 hp, are mounted high on the wing in typical Grumman amphibian style. They are equipped with three-bladed Hamilton Standard *Hydromatic* propellers.

Maximum speed is 270 mph; cruising 225 mph; range 600 miles when heavily loaded with personnel—1400 miles when hauling cargo. Ferry range is approximately 2600 miles. Wing span is 80 ft; length 61 ft 4 in; height on wheels 24 ft 5 in. This biggest of



Grumman amphibians is equipped with a tricycle landing gear.

The SA-16A is the product of extensive hydrodynamic research, in which Grumman and the Navy received considerable assistance in hull design from the NACA and the Stevens Institute of Technology. It is claimed that the design incorporates more freedom from "porpoising" and instability on rough water than any Navy plane so far developed. It is expected to operate in waves up to four and one-half ft high.

A hatch measuring 58 in by 63 in is built into the top of the hull to facilitate transfer of cargo. Rescue operations take place through a "Dutch" door in the side, divided horizontally. The upper half is opened and the bottom half remains closed to provide greater freeboard in rough water. A counter-like attachment is

hung on the outside of this half door and a crewman—secured by a safety belt—uses this surface from which to haul rescued persons out of the water and aboard the plane.

Provision is made for the use of JATO units, which are claimed to give the *Albatross* a 12-sec take-off from water. Successful test flights of the prototype from land and water were claimed last winter by the Navy.

The SA-16A may be the nearest thing to unification in which the Air Force and Navy have found themselves. Differences between the AF and Navy version are mainly those of radio and radar equipment and a slight change in seating arrangements. Rescue planes for both services are identified by yellow wing tips and a yellow band around the rear of the hull. The Navy has ordered six of the JR2F amphibians.

Additional Air Force Equipment

Under earlier contracts North American received orders for 250 F-82 long-range fighters. The *Twin Mustang* is powered by two 2250-hp Allison engines.

Aeronca is supplying 600 L-16s (two-place commercial version modified for the military) for the Army through the Air force. Bell has an AF contract for 85 YH-13 (Model 47) helicopters.

Northrop is building 23 three-engined *Raiders*, military version of the versatile *Pioneer* transport. Designated C-125, the plane will be used as a light "assault transport" and for arctic rescue work. Engines are 1200-hp Wright Cyclones.

The Air Force is also receiving 10 C-121 *Constellations* from Lockheed under a fiscal 1948 contract.

Magnetic Field Strength and Direction Measurement

MAGNETIC forces have been gainfully employed by engineers in hundreds of applications from the lowly doorbell to the incredible machinery used to split the atom. On the other hand, designers have been forced to grapple with the ill effects of residual magnetism, which can exist naturally or appear as the result of metal-working operations.

Residual magnetism will throw instruments out of balance, cause control circuits to misbehave, cause close-tolerance jigs and dies to lose their precision and even cause bearings to fail. In aircraft, residual magnetism more than once has been the cause for compass deviation and the consequent inability of the pilot to navigate his way to a safe landing.

Specifications for aircraft materials, devices and compasses set certain limits on the degree of magnetism permitted for the various parts of the structure. Control must be applied to materials in the process of being fabricated and while the components are being assembled. Once the aircraft is operational, the structure and components must again be examined for residual magnetism, to be on the safe side.

A way to detect and measure this magnetism is made available by Thomas E. Smith Associates. Smith Magnetometers uncover

and measure magnetic forces; show where and how much demagnetizing is necessary to neutralize them.

They consist of portable meters, in three models: (1) Materials inspection, to measure the amount of residual magnetism in steel parts or assemblies; (2) precision analysis of magnetic fields in aircraft; (3) determination of the amount of magnetic influence where a magnetic compass is installed. Also, (4) this instrument can be considered as the azimuth-determining device in guided missiles.

Essentially, each Smith Magnetometer consists of a pickup unit and an indicator. The pickup has a magnetic element that responds to the strength and direction of a magnetic field. The indicator unit amplifies this response and gives a direct reading of the intensity of the field, and its direction.

Thomas E. Smith, an MIT graduate who has a long record of Marine engineering and who collaborated years ago with Anthony Fokker, states that the magnetometers are sensitive enough to pick up magnetic fields that cause a deflection of one-half degree on the compass, and sensitivities ranging from 0.30 to 900 milli-gausses.

Smith Associates also present their GW-2 Gradientometer, used primarily for quickly locating non-uniform magnetic fields. Unlike the magnetometer which is used for measuring magnitude and direction of magnetic forces, the gradientometer is non-responsive to uniform magnetic fields, such as the field around the earth. Thus, it may be held in the hand and used freely in testing for residual magnetism, or in searching for lost tools, underground piping, conduits, etc.

It has been used by the Navy and several large oil companies for corrosion-current measurement.

In normal operation, it locates and measures gradients in magnetic fields. By throwing a switch it becomes a magnetometer. A calibration control varies the sensitivity of the unit.



Smith Magnetometer being employed to determine the amount of magnetic influence around the installation of a compass in an aircraft. Guided missile field is new use

The gradientometer also consists of a pickup-and-indicating unit. The indicator contains a stabilized amplifier and an electronic bridge calibrated to indicate the strength and polarity of the magnetic field. The pickup unit is essentially a pair of magnetometer pickups separated at a fixed distance and so oriented that output signals are in opposition.

This instrument should be operated from a well-regulated source of alternating current.

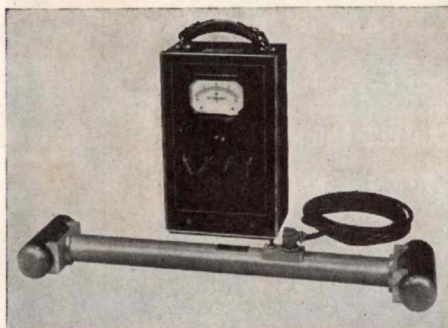
Slick Expands

Slick Airways, Inc., nationwide airfreight carrier, was the first major airline to transfer its operations (as of August 1) from Chicago Municipal Airport to the spacious, recently opened Douglas Airport on the northwest side of the city.

The 19-mile shift of the airline's office and station equipment was made in the company's own airfreight planes—probably the shortest airfreight haul in history.

During the first six months of 1948, Slick Airways flew 13,539,714 revenue ton-miles of freight, an increase of 38% over the amount carried during the first half of 1947.

The company is increasing its fleet with additional C-46 *Commando* planes in anticipation of growing tonnage in the late summer and autumn seasons.



Gradientometer locates non-uniform magnetic fields; is useful for corrosion-current measurement and finding buried piping, conduit or tools. May be held in the hand

AIR MEETINGS AND EVENTS

September

- 2-4—Flying Farmers Association National Convention. Ohio State University
- 4—Early Birds Reunion and Banquet. Cleveland
- 4-6—National Air Races. Cleveland
- 6—ICAO Air Navigation Committee. Montreal
- 7—ICAO Council, Fifth Session. Montreal
- 7-12—Society of British Aircraft Constructors Show. Farnborough
- 8—ICAO Air Transport Committee. Montreal
- 9—IATA Legal Committee. Brussels

12—Oakland Aviation Day. Municipal Airport, Oakland, Calif.

13—IATA Executive Committee. Brussels

14-18—IATA 4th Annual General Meeting. Brussels

18—Air Force Day

19-21—Northwest Aviation Planning Council 12th International Convention. Vancouver, B. C.

20—IATA Executive Committee. Brussels

27 (to Oct. 1)—3rd National Plastics Exposition. Grand Central Palace, N. Y. City

October

6-8—National Association of

State Aviation Officials Annual Convention. Copley Plaza, Boston

6-9—SAE National Aeronautical Meeting and Aircraft Engineering Display. Biltmore Hotel, Los Angeles

11-13—Semi-Annual Convention American Society of Tool Engineers. Biltmore Hotel, Los Angeles

12-16—5th National Chemical Exposition. Coliseum, Chicago

14-16—Air Line Dispatchers Assn. Convention. Edgewater Beach Hotel, Chicago

15-24—International Aircraft Exhibition, Royal Danish Aeronautical Society. Forum Exhibition Hall, Copenhagen

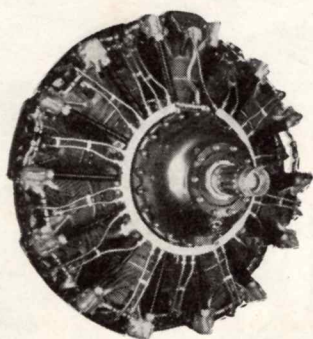
17-21—National Aviation Clinic. Detroit

18-22—36th National Safety Congress and Exposition. Chicago

20-21—National Conference on Industrial Hydraulics. Hotel Sheraton, Chicago

22-23—4th Annual Arizona Aviation Conference. Prescott

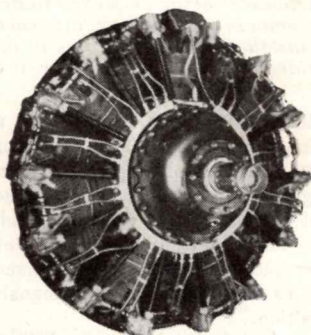
25-29—30th Annual Convention, American Society for Metals. Philadelphia



R1830-92

150

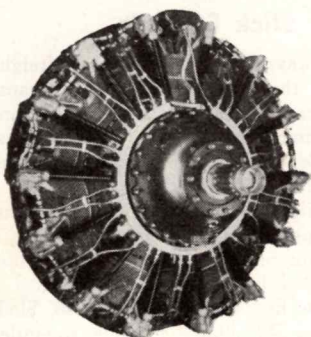
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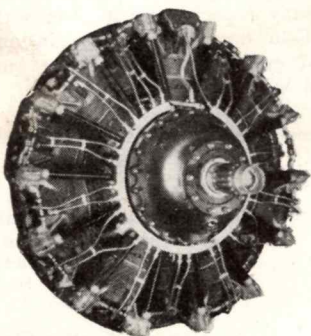


R1830-43-65

(Converted to 1830-92)

250

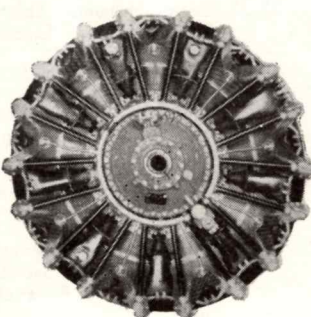
MAJOR OVERHAUL (military) first run (average total time 300:00 hours) with zero time since conversion to R1830-92 specification by recognized agency, block tested C.A.A. Form 337, warranted; each \$1795.00



R1830-43-65

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R1340 -AN1

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WRIGHT R2600-29, -13, -8

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Geneva, Switzerland

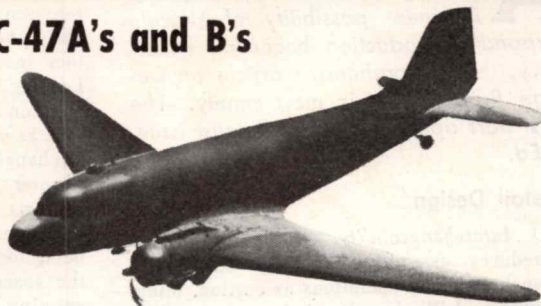
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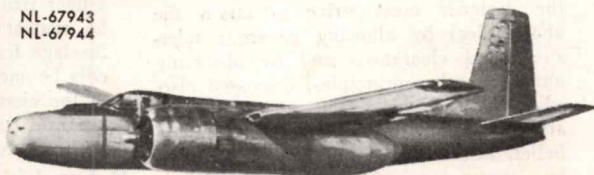
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Design Producibility Serves the Industry

PART II

WALTER R. JONES and HAROLD M. HARRISON

Respectively Chief Staff Engineer and Dept. Mgr. Production Engineering
Lockheed Aircraft Corp.

AS THE Air Force modernization program gets under way, with the imminent possibility of sharply expanded production becoming necessary, this comprehensive article on Design Producibility is most timely. The first part appeared in our August issue.—Ed.

Detail Design

(1) *Interchangeability.*—Interchangeability reduces assembly costs by eliminating such tailoring operations as cutting, filing, fitting, drilling and reaming at assembly stations. Ideally, all fabricating operations should be executed in fabrication shops, so that assembly operations are comprised exclusively of connecting parts. While tooling policies influence these practices, the designer must strive to attain the above ideal by allowing generous tolerances and clearances and by observing numerous other principles, discussed elsewhere herein, which promote interchangeability. Contrary to an all-too-common belief, interchangeability is best achieved by a generous provision of tolerance.

The interchangeability of certain parts and assemblies is dictated by spares and service requirements. The demands of producibility, however, require that many other parts and assemblies be made interchangeable, and since it may almost always be attained without compromising other desirable characteristics, the designer must take full advantage of this principle.

(2) *Adjustment and Take-Up.*—Adjustment provides for unavoidable variations between units and serves not only for assembly but also for field operations by preserving interchangeability for spares provisioning. Adjustment provisions require appreciable expenditure of effort so, although invaluable when essential, they should be used with great discretion. Producibility depends on experienced judgment in their application.

Elongated holes provide the least expensive means of adjustment, although structural requirements may necessitate that they be accompanied by serrated faces on mating parts. Angular adjustment may be provided by the use of universal joints. For angular variations in a single plane, radial serrations may be used. When bearings are mounted on build-up sheet metal structure which is subject to variations from riveting strains, the spherical type will furnish adjustment. Turnbuckles furnish another typical means of adjustment, as do threaded rod-ends.

Take-up is that means provided for absorbing accumulations of tolerances and unpredictable manufacturing variations and, in contrast with adjustment, is applied

permanently at assembly and therefore is not available for servicing or repair. Shims represent a most primitive form of take-up. They should be avoided if possible since they involve expensive selective assembly. Leaving holes blank in a part and drilling them on assembly from holes in the mating part represents a form of take-up, but interchangeability is thereby sacrificed.

Whenever a part must fit between the faces of parts on separate assemblies, tolerance variations often result in either the part being too large to enter or too small to fill the space between the faces. Hence, the entering part should be made sufficiently small to assure its entry, and a separate angle or clip should be provided for taking up the full space.

For example, if one flange of a channel is to be installed against the under surface of a floor structure and the other flange is to be against the upper surface of a lower fuselage frame, difficulties would undoubtedly be encountered. Therefore, one flange of the channel should be replaced with a separate take-up angle drilled for the channel rivets at assembly. (Fig. 14.)

Modern lofting and tooling practices have fortunately eliminated excessive take-up requirements; but the designer must be alert to provide sufficient take-up as needed and only when needed. Otherwise, assembly line hold-ups occur when the mating of parts can be accomplished only by reworking them on the line.

(3) *Tolerances.*—Generous tolerances often result in fewer and speedier fabricating operations on less critical machinery by less skillful labor. Parts which may be turned on turret lathes or screw machines may require grinding if tolerances are confining, and even lapping may be necessary if the allowance is exacting. Stress analysts usually endeavor to relax tolerances when they are made cognizant of the extra operations which are imposed by confining tolerances.

Aerodynamic smoothness imposes close tolerance requirements on the exterior airplane surfaces. Such tolerances, however, should be applied intelligently, so that surfaces in less critical areas are permitted greater dimensional variations than

those in critical areas, such as the entering edges of airfoils and ducts.

It must be assumed by the designer that the fabrication tolerances specified may be utilized to the limit by the factory, and he therefore should resist the common tendency to specify tolerances on an assembly which are more exacting than would result from full indulgence in the fabricating tolerances on all the component parts. For example, tolerances on airplane-exterior smoothness and flushness—and the specifications establishing them—should allow for the variations which may result from assembling the variable components involved.

The tolerance on head dimensions of flush screws, which are additive to the tolerance of countersinks and formed dimples, ordinarily exceeds the allowance desired for aerodynamic requirements. If flushness specifications are more confining than these factors allow, the factory is required to install screws by countersinking according to individual screw-head dimensions, or by selecting screws to match formed dimples within the flushness specification.

The openings between control surfaces and the trailing edges of their mating assemblies are sometimes specified with tolerances which cannot be adhered to if the full individual tolerances of the fabricated parts are exercised. Either greater laxity should be allowed for the assembly or more confining fabrication tolerances should be required; or means must be provided for taking up or adjusting the opening at assembly to meet the specification.

(4) *Adequate Clearances.*—Inevitably in congested areas, the designer is tempted to be optimistic about clearances and provide less than experience dictates is needed. If he succumbs to this temptation, producibility invariably suffers. Instead of a smooth-flowing assembly line, there is encountered a conglomeration of workmen from various fabricating and tooling departments endeavoring to get a "fix" on the difficulty.

If a fix is obtained, it cannot make up for the losses incurred during that most critical period in the life of a model when production is being initially accelerated. The difficulty seldom can be fixed to provide as satisfactory a design as could have resulted from adequate allowance for clearances in the original design.

Some difficulties imposed by inadequate clearances, particularly where moving parts are involved, can never be properly remedied, and the factory must struggle with them until the ultimate discontinuance of the model. Clearance should be provided, using the most critical combination of tolerances of all contributing dimensions.

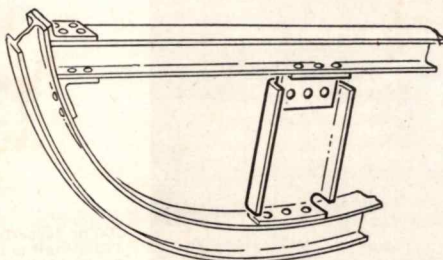
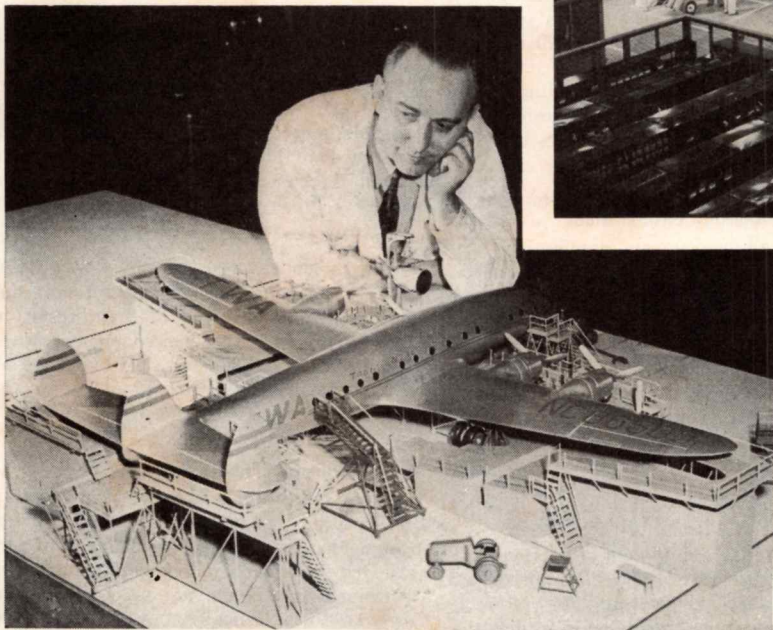


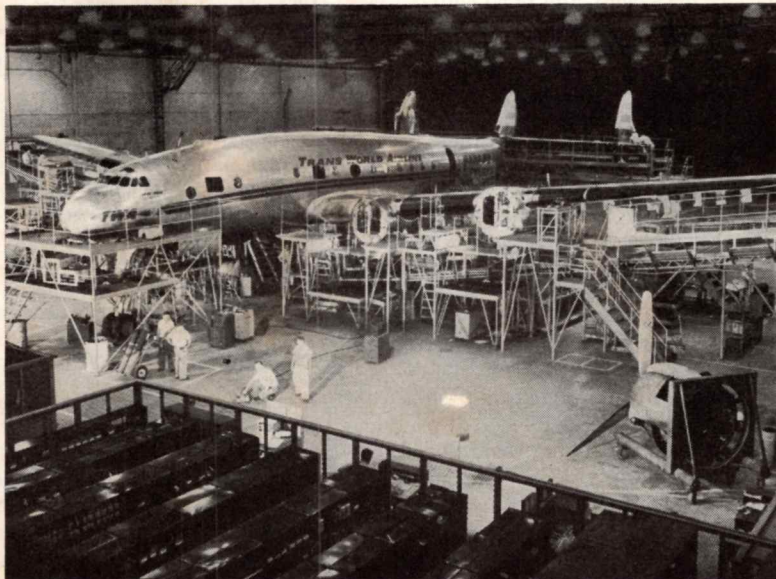
Figure 14

One reason that theoretical clearances between objects appear to vanish in practice is that fabricating shops tend to work to the safe or greater side of dimensions, resulting in additive tolerances. Hence, designers who gamble that the law of averages will play in their favor are destined to lose.

(5) *Rework Margins.*—The drilling and reaming of structural connections is sometimes accomplished after the components are otherwise complete, and frequently after they are installed. If, due to unfore-



By putting in scores of hours on a detailed model of a work dock for the Lockheed "Constellation," TWA's project engineer for the intricate structure saved the company thousands of dollars. Shown above is the dock in operation at TWA's Kansas City Overhaul Base



seeable variations or inaccuracies, the margins around the finished holes are less than prescribed, serious rework is imposed to replace the item, not to mention the losses due to scrapping.

Producibility is improved by allowance in design for such circumstances, which experience proves inevitable, by providing extra material around critical holes, permitting the use of the next-larger size standard bolt or the insertion of bushings to permit the regular bolt size to be used. This insurance has proved invaluable to continuous assembly-line flow.

(6) *Adequate Edge Distances.*—A generous edge distance for rivets and screws is good insurance for producibility. Structural sections and intersections of members must provide for the variables encountered in locating holes, especially when drilling is to be accomplished from the exterior surfaces of assemblies and the actual edge distance ultimately observed when the drill emerges from the land on the inside of the assembly. Unless generous land is provided, inadequate edge distance results and expensive rework inevitably becomes necessary.

Machining Economy.—Although observance of the principle of accessibility contributes to the simplicity of machining, there are

many other considerations which should be observed. Obviously, the greatest machining economy is attained by using raw-material surfaces whenever they may serve the purpose, thus eliminating machining entirely. When machining is required, the design should permit it to be performed on the least critical machinery. Spotfacing, for example, can be accomplished on a drill press and that procedure is generally preferred to milling.

Fabrication access of a machined part permits its machining with tools which efficiently remove material and with machine feeds conforming with those available on conventional standard equipment. For example, finish-machining the inside faces of three-walled corner fittings where the angles are acute does not permit the use of a cutter whose radius exceeds the radius of the fillet.

Lack of sufficient access for machining results in the use of tools entirely inadequate for the job; chips must be removed by "picking away" or "sculpturing"—practices which are intolerable in production shops. The machining of cylindrical surfaces which blend with other cylinders, or which blend with plane surfaces not normal to the cylinder axis, penalizes fabrication access and results in sculpturing.

Reaming after drilling should be specified

only when the closer tolerances achieved thereby are absolutely essential. Small-diameter holes for valves and ports should be decreased in length by leading through most of the distances with a larger-diameter drill. The machining of long thin shafts is difficult, regardless of steady-rest provisions, and may be avoided by such means as up-setting.

When large areas are to be mated, the provision of bearing pads thereon will effect considerable reduction in machining, since only the pads require this operation. This is especially helpful on contoured surfaces. In turning, boring, threading, and grinding to a shoulder, a relief should always be furnished if possible. The relief should be wide enough so that it can be machined with normal cuts; if too small, it will require "picking out" of the material. Any machining which cannot be performed with conventional feeds reflects poor producibility.

Inexperienced designers have difficulty realizing that a conventional-type plumbing elbow cannot be machined from bar stock on any existing conventional machine-shop equipment. When a machined part must mate with a contoured surface, a series of straight lines can often be substituted for the contoured lines without a discernible difference, thus permitting machining by straight machine feeds instead of by duplicating to contour which involves highly skilled labor and expensive equipment.

Fillet radii should be consistent throughout a machined part, not only to permit continuous use of the same cutter, but to avoid the necessity of blending the fillets from different cutter radii. A machined surface should not be required to blend with a cast, forged, or extruded surface; the design should provide clearance for the cutter or should permit cutting below the unfinished surface. Provisions for holding work while being machined must be considered and, if necessary, there should be incorporated hold-down tabs or lugs, which may be removed after machining.

Where a choice between ferrous and light alloys is otherwise about even for any certain part, the latter should be chosen because of the greater cutting speeds permissible. The finish requirements of machined sur-

faces should comply with rapid cutting feeds and speeds. By permitting as rough a surface as is commensurate with the required functioning of a part, fewer machining operations are required, especially of the more expensive types such as a grinding, honing, lapping, polishing and slow cutting. Any machined surface not mating with another should not be smoother than 500 micro-inches. No surface finish less than 100 micro-inches should be specified without deliberation and assurance that it cannot be avoided.

Expansibility

Expansibility is that attribute of design which renders its rate of production capable of being rapidly accelerated and maintained. The necessity for a centralized Government agency providing data regarding the availability, and in certain cases controlling the usage of critical materials, facilities, skills, etc., during a National Emergency, has been mentioned. Any limitations imposed thereby must be given prime consideration by the designer, in order to insure continued production with any required degree of expansion. The following are some of the more important factors which influence design expansibility.

Materials.—Because of the unpredictable influences of an emergency on material sources, designs based on early forecasts may encounter unanticipated shortages. Hence, foresight should be used to insure that suitable substitute materials may be employed with a minimum of design revisions to maintain uninterrupted production at the mobilization peak. Likewise, the choice of fabricated materials such as extrusions, castings and forgings should include the possibility of substitutions being necessary when any peculiarity such as size or shape limits procurement to a single source.

Standard and Commercial Parts.—The supply of certain standard or commercial parts may become critical. During the past emergency, the sources of aircraft ball-bearing assemblies proved inadequate to meet demands until steps were taken to supply bearings of lesser quality where the application permitted. Parts of a proprietary nature are sometimes procurable from only a single source.

While licensing may be resorted to as a means of expanding supply, critical shortages are likely to be encountered before the new sources are productive, resulting in the necessity for the substitution of other products. Expansibility may again depend upon the suitability of the design to permit such substitutions with a minimum of revisions.

Accessories.—The selection of accessories and engines is vital to expansibility. This is true because it is rarely practical to provide substitutions without appreciable delays which result from the imposed redesign of the supporting structure and related functional installations. Accordingly, designers have exercised foresight to the extent of predicated an airplane design on alternate

types of engines. Likewise, alternatives should be considered for all vital accessories.

Facilities, Equipment, and Techniques.—For rapid expansion, designs should be suitable for extensive sub-contracting; hence, they should not be predicated on equipment, facilities, or techniques peculiar to any one factory or locality. When the design is such that highly specialized machines are required, the supply of which would be critical, it should be capable of easy conversion to suit more universal equipment.

Flexibility in the design will permit spreading of manufacturing to various sub-contractors during an emergency. For example, if panels are designed with stringers spotwelded to sheet, with sufficient edge distance to permit riveting by potential sub-contractors not possessing expensive spotwelding equipment, the adaptability of that design to a greater number of facilities renders it highly expansible.

Relation of Design Producibility to Other Design Considerations

It is an all-too-common assumption that considerations of design producibility necessarily involve some compromise of airplane performance, weight, serviceability and other important airplane characteristics. This assumption is erroneous; in many cases the most satisfactory design from the standpoint of producibility will result in an improvement in other desirable elements. This will be evident from a consideration of the following.

Performance.—Straight-line Systems for controls result in a minimum of friction, thus decreasing the control effort required and improving stick-free stability by reducing hunting tendencies. "Sponginess" and flutter tendencies in control systems, resulting from the flexibility and play in pulley supports and control-element connections, are also minimized in straight-line systems.

A Minimum Number of Major Structures usually results in minimum drag and hence contributes to higher performance. A Minimum Number of Parts resulting from the use of inner skin stampings, as well as from the employment of heavy skin gages, will aid in the attainment of smooth exterior surfaces, thereby contributing to improved performance.

Serviceability.—Accessibility required for producibility will result in accessibility for service and maintenance. Production Breakdown, providing ease of handling, assembly and installation of units in the factory, render these same units convenient for handling and easy to remove or re-install in the field. Completeness of Breakdown Units aids servicing, especially by the use of quick-disconnects for removal and replacement of major components at service joints.

Joint designs, made with minimum connecting points to avoid redundancies of constraint, result in speedier maintenance operations. Interchangeability provided for manufacture is an asset for service and maintenance. Adjustment provisions incorporated for assembly prove invaluable in service. Generous Tolerances simplify the problem of field installations and replacement.

Straight-line Systems for control cables result in minimum points of wear, and simplify

inspection and replacement. The same principle applied to push-pull control systems likewise reduces the points of wear and consequently the necessity for inspection, lubrication and replacement.

Reliability.—Simplicity of design is a key-stone of producibility. Simplicity enhances reliability of operation, avoiding many of the functional troubles inherent in complex designs.

Structural Efficiency.—Simplicity required for producibility is an inherent quality of good structural design. In the interests of producibility types of construction are usually selected whereby loads are transmitted from one area to another by the most direct path—a principle often advantageous from the standpoint of structural efficiency. Effectiveness of breakdown is advantageous to structural efficiency, since it eliminates unnecessary breaks in the structure.

Weight.—The incorporation of a number of separate elements into an integral unit, for improved producibility, will often result in a weight saving. Also, the comments above, under Structural Efficiency, are indicative of weight economy resulting from design for producibility.

Incorporation of Changes.

Designs reflecting maximum producibility are generally characterized by simplicity. Design changes dictated by changes in tactical requirements, or by manufacturing or operational experience are more readily incorporated in a basically simple design, since a detail change will ordinarily have less effect upon the surrounding structure and attachments than would be the case in a more complex design.

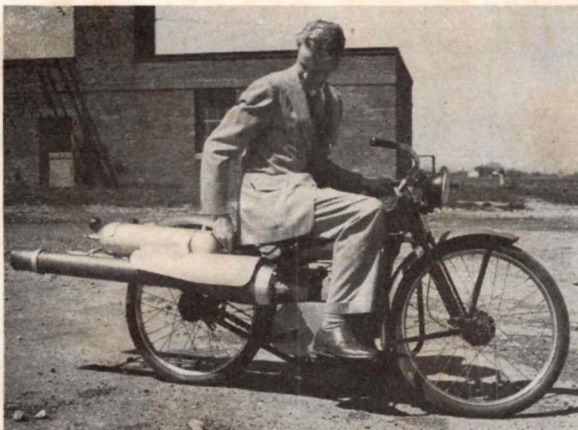
It is well known that complexity—the antithesis of producibility—begets complexity. It results in a multiplicity of parts; redundancy besets the structures engineer; weight is increased by the necessity for the mutual attachment of the many parts and for transmitting loads from one part to another; accessibility is penalized as one part obstructs access to another; reliability is jeopardized by the increased possibility of malfunctioning of an excessive number of parts.

In summary, it is evident that producibility is compatible with many other desired design characteristics. Certainly producibility achieved by an undue limitation of other features of design does not reflect an intelligent approach to the problem and, in the end, will defeat itself by rendering the design inadequate as a tactical weapon or inefficient as a commercial vehicle. Under such circumstances, "the experimental prototype is sufficient to saturate the demand" for that model—and hence its potential producibility can never be realized.

(Continued on page 120)



TAKEOFFS AND TURNS



Jet Engines for Civil Use

Aeromarine Co., Vandalia, Ohio, announces the first U. S. jet available for non-military purposes. Two D5-1 units are shown power-

ing a light motorcycle. Each develops a 30-lb static thrust; weighs 8.75 lb; is 6 3/16 in in diameter; and 51 in long.

Manifold-Vent Aircraft Batteries

Willard Storage Battery Co. explains its vent manifold as running lengthwise of the battery, with exhausting gases feeding into it from all cells. Tubing carries the gases from the manifold to the atmosphere. Willard batteries have received CAA approval for installation without enclosed battery boxes.

ASTM Index to Standards

The American Society for Testing Materials issued a revised index as of December 1947. The publication is an adjunct of the big 1946 book of standards (6600 pages) and the 1947 supplements (1800 pages). Copies are available at ASTM headquarters, 1916 Race St., Philadelphia 3, Pa.

Spun Glass in Stretch-Forming

The Glenn L. Martin Co. utilizes spun glass, woven into thin blankets, as the buffer material between the form block and sheet being formed during stretch-forming operations.

History of Glassmaking

Libbey-Owens-Ford has produced a book for its employees which briefly tells the story of glassmaking from the early days to the most modern practices, introduces special products and services and acquaints the worker with a nationwide system of plants.

Armament Contract

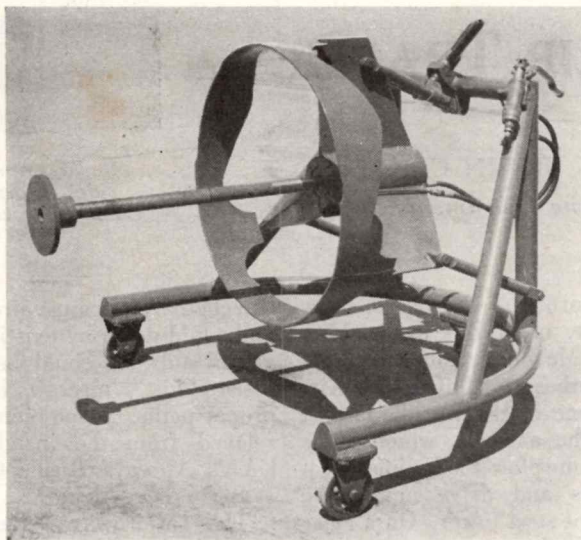
Emerson Electric Manufacturing Co. has received an Air Force order for aircraft gun turrets and electronically-controlled gun-firing mechanisms for bombers and patrol-type planes.

Airports and Civil Aircraft

The CAA recorded 6210 airports as of July 1, 1948; a year earlier the total was 5251. The number of civilian planes on July 1 was 97,743, compared with approximately 83,571 one year earlier.

Lathe Care

South Bend Lathe Works has issued a 16-mm color, sound film entitled *Grinding and Use of Basic Lathe Tool Cutter Bits*. It is Film III in a series on how to operate a lathe.



Tire Dismounter

The Institute of Inventive Research, San Antonio, Tex., has released for manufacturing an aircraft tire dismounter invented

by Thomas Carmichael. Hydraulic pressure is utilized to push and pull simultaneously on heavy tires to loosen stubborn beads.

Materials Handling

General Electric, in the 1948 edition of its "More Power to America" program, is featuring the economics of efficient handling of materials in receiving, warehousing and shipping. The program consists of a sound motion picture in color and a valuable 96-

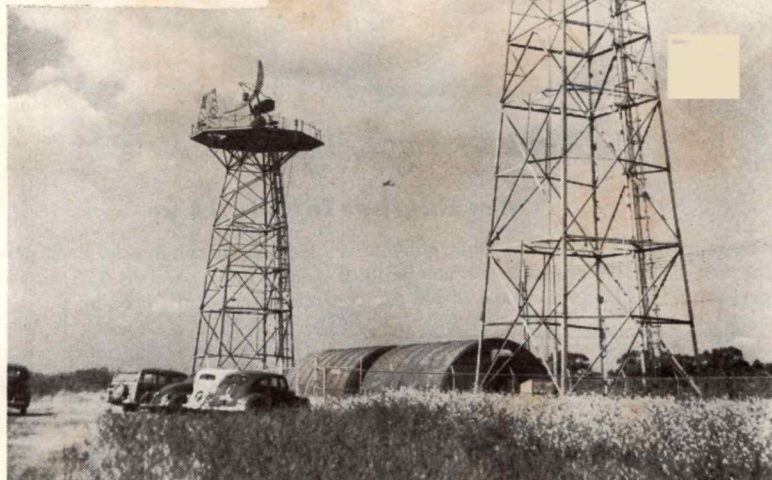
page application manual. Materials handling, almost pure overhead, is said to be one of industry's largest costs. No specific product is advertised in the program; each type of truck, crane or conveyor is pictured operating where it can do the most good.



CAA observer watches electronic "video" map of airway ranges and markers near LaGuardia

NEW YORK RADAR CHARTS AIR TRAFFIC

IRWIN C. NYE
Airborne Instruments Laboratory



Radar towers at Queens College installation. Tower at left provides information on the elevation of all airplanes in the area; the tower at right gives azimuth on planes within 30-miles radius

IN THE Borough of Queens, New York City, on a hill overlooking Flushing Meadows, four and one-half miles southeast of LaGuardia Airport, stands one of the world's largest radar sets. The antenna, which looks like a giant snowplow blade, and associated circuits and drive motor are atop a 100-foot steel tower. On a clear day, the installation may be seen from the south end of the Airport.

Sixteen hours a day, four times every minute, the giant antenna "sweeps" the skies in a 50-mile radius, providing surveillance over the aircraft which throng the skies of the nation's busiest air-terminal area. Equipped with a circuit which keeps stationary objects (buildings, hills, and other ground reflections) from showing on the radar scopes, the set is provided also with an electronically created map of the airway ranges in the terminal area. This map permits comparison of the routes

travelled by various aircraft with the paths laid down by existing radio navigation aids. It could be used also to assist "lost" aircraft back to their proper paths. Scope pictures are radio-relayed from the installation of the CAA's Airways Traffic Control center at LaGuardia Airport.

The Microwave Early Warning search radar, which saw some wartime use in the islands of the Pacific and in Europe, performing tasks in line with its name, was chosen for the New York installation from among several possible Army and Navy equipments as the most suitable because of the following reasons:

1. It provides high resolution in azimuth and range, with a 1° azimuthal beam width and a two-microsecond pulse length. Beam peak power is 400-to-600 kilovolts.
2. It provides sky coverage up to 40,000 ft within an elevation angle of 30°

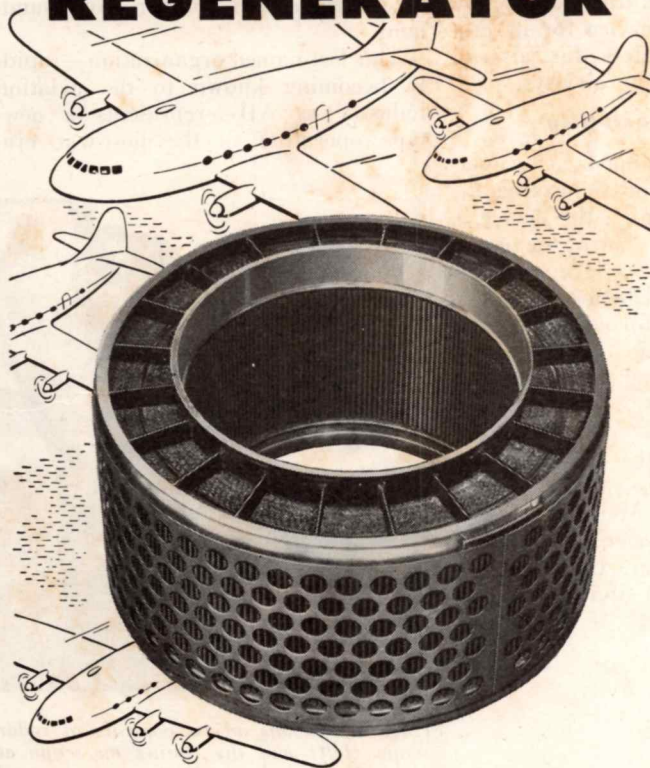
from the horizontal and has a reliable range of 100 miles on the lower of its two beams. The upper beam (the one most predominantly used to date) gives adequate coverage within a radius of 50 miles. The long-range beam was put into operation shortly before April 1; the 50-mile beam has been in operation since mid-1947.

3. Its indicating equipment is comprised of a number of 12-in PPI (plan position indicator) radar scopes which can also be adjusted at will as expanded sector displays and on which may be displayed various artificially provided signals along with the regular radar "pips." This latter feature makes possible the presentation of an electronically provided "video" map of the airway ranges and markers on the same scope with the data picked up by the radar signals.

4. It was possible to modify the equipment to eliminate almost entirely the usually troublesome "ground return" signals, leaving only radar "echoes"

Although the specific radar installation described herein was almost completely destroyed in a grass fire, a brief description of it is given at this time, first, because it reports on a recent phase of a research project essential to both national defense and more adequate air-traffic control; and second, because there is now every indication that the Civil Aeronautics Administration will, in the immediate future, authorize its reconstruction at a location nearer to LaGuardia Airport. —Ed.

New **YOUNG** Engineered **GAS TURBINE REGENERATOR**



● The latest development in the aircraft heat transfer field is this Young-designed regenerator for gas turbine-propeller engines or auxiliary power plants. Of particular interest to designers and builders is the fact that tests in similar installations have shown amazing reductions in fuel consumption by preheating the air as it flows from the compressor to the combustion chamber. Write today for further details about this and other aircraft cooling products developed by Young—specialists in the design and manufacture of heat transfer equipment since 1927.

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C.A.A. Approved—All aircraft work at TEMCO has full C.A.A. approval.

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AIRCRAFT MANUFACTURE—TEMCO is fully equipped to handle all aircraft manufacturing operations except such specialized components as engines, and propellers. Present production includes The Swift 125, all-metal business and personal airplane, and contract manufacture of components and sub-assemblies for many types of aircraft.

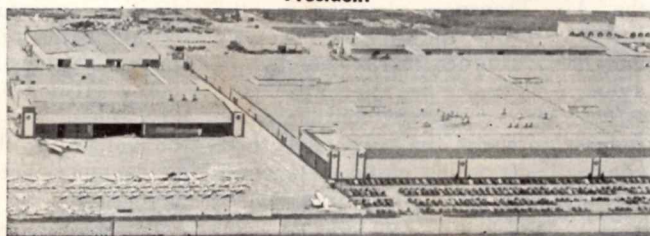
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from moving targets and the artificially provided "map" signals on the scopes.

In operation, the radar's beam "sweeps" the area within its radius of reach four or more times every minute. The video map is added electronically to the radar returns, and the combined picture is relayed to the Airways Traffic Control Center at LaGuardia Airport over a microwave radio circuit developed for that purpose by Airborne Instruments Laboratory. Data for synchronizing the radar scope picture at LaGuardia with that at the radar location at Queens College is sent over a regular telephone circuit, all other data being relayed by radio. The LaGuardia scopes are installed immediately adjacent to the controllers' positions, where it is most convenient to the controllers whose task it is to transfer control of specific aircraft to or from the jurisdiction of the airports in the New York terminal area.

Now manned and maintained by the CAA, this radar installation is evidence of the ability of various aviation interests to cooperate. Its erection result-

USAF expects to obtain new knowledge of specially-modified electronic circuits applicable to newer radar equipments.

The City of New York supplied the land on which the installation stands, and erected fencing to safeguard towers and buildings. In return, the City anticipates better air service for its citizens and greater safety for aircraft and homes beneath the airways.

CAA Responsibility

The CAA is providing men to operate the equipment, and is meeting the costs entailed in running the device, a large undertaking in view of the experimental nature of the program. In return, it hopes to find better, more efficient, safe processes for controlling air traffic flowing into and out of the numerous airways which converge upon America's largest city.

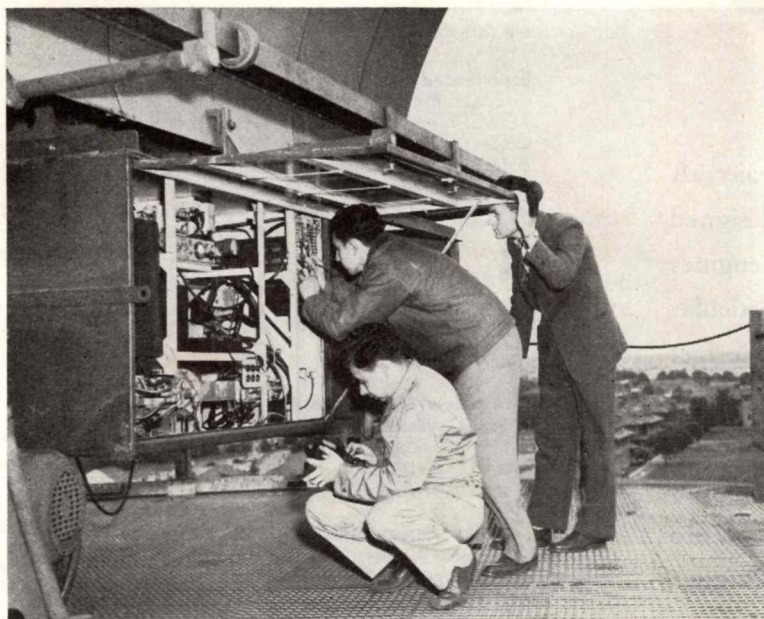
The Air Transport Association has footed the bills for the complex work required to revise the radar, from its wartime form as the Microwave Early Warning set, to the peacetime New York Air Surveillance Radar. Compensation will be in realization of its hope that

dered to the public and to the aviation industry; more has been learned of the "quirks" of radar; new circuits have been developed to make radar more valuable; and other installations have been started at points as far separated as Australia and Gander, Newfoundland.

This last-named organization—rapidly becoming known to the aviation industry as AIL—represents a new-type operation in the post-war era.



CAA technicians adjust controls of radar scope (left) and the timing on scope at right. Scopes show Airways ranges and markers, and moving planes as radar pips



On top of the main radar tower CAA technicians check the electric circuits of the 'electronic eye' which observes N. Y. area air traffic. Airborne Instruments Lab engineer Irwin Nye watches what goes on

ed through the cooperation and sponsorship of five organizations: the CAA, the Air Transport Association, the U. S. Air Force, the City of New York and the Airborne Instruments Laboratory.

The Air Force provided the basic radar equipment, the tower, and three Quonset huts which nestle at the base of the tower, providing space for research and for components not mounted overhead. In return, the

aircraft of the scheduled airlines (members of the ATA) will spend less time awaiting opportunities to land, thereby saving gasoline and flight time and sparing passengers' tempers.

And Airborne Instruments Laboratory, which has done the revamping job and trained the CAA operators and maintenance people and coordinated the participation of all five groups, has achieved its aims. As far as it is concerned, a definite service has been ren-

Prior to the war, there were no such organizations in which the problems of many groups could be pooled to seek joint solutions and apply the answers found in one quest directly to the problems of another. Wartime efforts and accomplishments of the scientific laboratories under the Office of Scientific Research for Defense and the National Defense Research Council, established a pattern for operation and paved the way for this new-type institutional-industrial research laboratory.

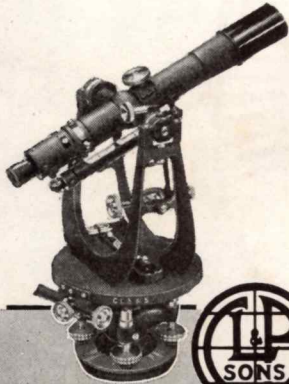
On the Agenda

When cut-backs in the war-research program came on V-J Day, there remained several projects under way in laboratories at Columbia University, Harvard University, and at Massachusetts Institute of Technology. Certain of these, the Armed Services decided, needed to be carried on to completion. Since the airline industry recognized the value inherent in having well-trained scientists equipped with adequate tools to work toward overcoming aviation's many problems, there was reached a solution which brought certain scientists from the three wartime laboratories together at the "plant" operated under Columbia University.

(Continued on page 115)

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Basically, the answer is the projection of optical lines and the elimination of wires by the use of the Berger Collimator.

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Literature will be sent upon request.

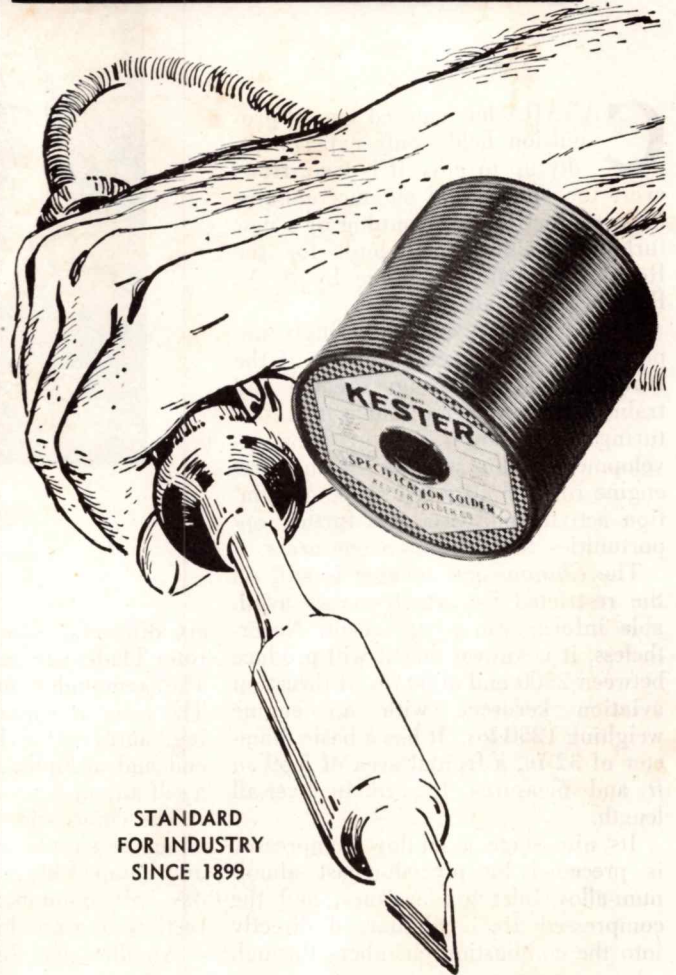
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Canada's First Aircraft Jet Engine

The "CHINOOK"

CANADA has entered the jet-propulsion field—only experimentally up to now, it is true. However, the spring and summer months have marked the test running of a new turbojet designed and built for the Royal Canadian Air Force by A. V. Roe, Ltd., of Canada.

AVRO Canada, an increasingly important across-the-seas member of the Hawker Siddeley Group, created and trained a design team and a manufacturing organization for this new development. The running of the first engine rounds out a full scope of aviation activity and promises further opportunities for Dominion engineers.

The *Chinook* gas turbine is still on the restricted list which makes available information pretty scant. Nevertheless, it is known that it will produce between 2500 and 3000 lbs of thrust on aviation kerosene with an engine weighing 1250 lbs. It has a basic diameter of 32 in, a frontal area of 5.59 sq ft and measures 125 in in over-all length.

Its nine-stage axial-flow compressor is preceded by precision-cast aluminum-alloy inlet guide vanes, and the compressed air is discharged directly into the combustion chambers through

six diffusers. The first two stages of rotor blades are made of stainless steel. The remainder are aluminum alloy. The rotor is supported in a self-aligning, anti-friction bearing at the front end and a duplex-type ball bearing, in a self-aligning mount, at the rear.

The combustion system seems to be about as simple and direct as that of any comparable gas turbine going today. Six combustion "cans" feed directly into a nozzle box for the turbine.

An alloy-steel disc with an integrally-

forged stub shaft makes up the turbine rotor. Chrome-nickel blades are fastened to the rim with fir-tree roots. Cast chrome-cobalt nozzle guide vanes are employed. The front end of the turbine shaft connects directly with the rear of the compressor rotor through a flexible coupling designed to compensate for angular misalignment.

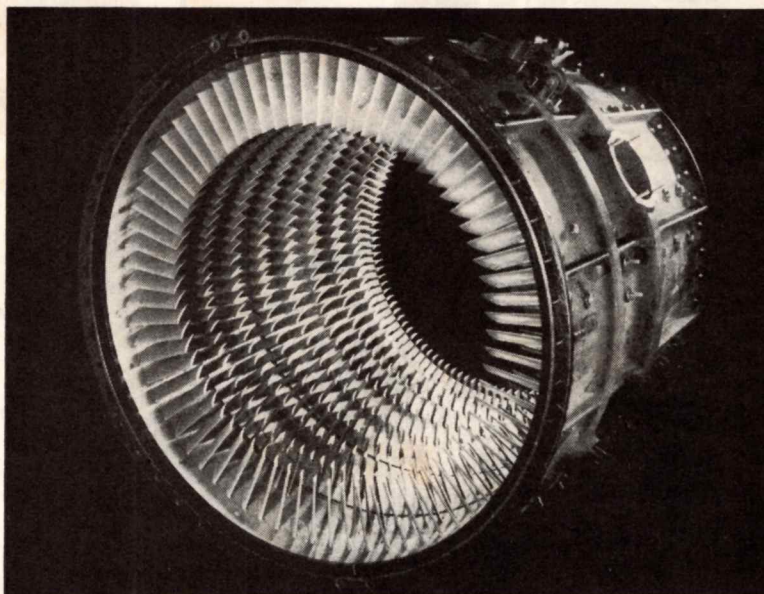
Tail-cone fabrication is stainless-steel sheet with cast flanges at front and rear. Glass-wool blankets, encased in silver-foil sheets under a sheet-aluminum outer covering, is the insulation.

The fuel system comprises two Lucas variable-delivery, positive-displacement pumps, one flow-control unit, a pressure-regulating valve, six burners, a combined solenoid and torch igniter reducing valve and two torch igniters.

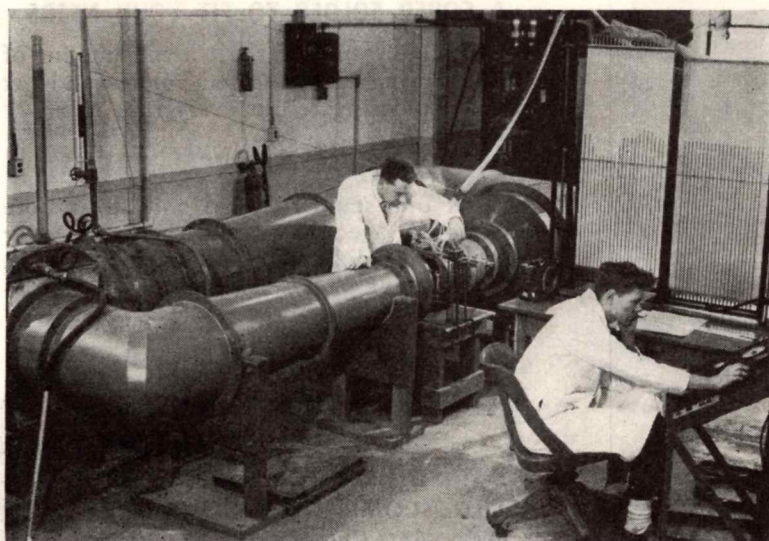
Dry sump lubrication is incorporated; the system includes one pressure and two scavenge units. The scavenging pumps draw oil from the front and rear main bearings. The center bearing is drained by gravity, both fore and aft. An oil tank, filter and pressure regulator complete the system.

A direct-drive electric starter, operating off a 24-v d-c supply, is furnished.

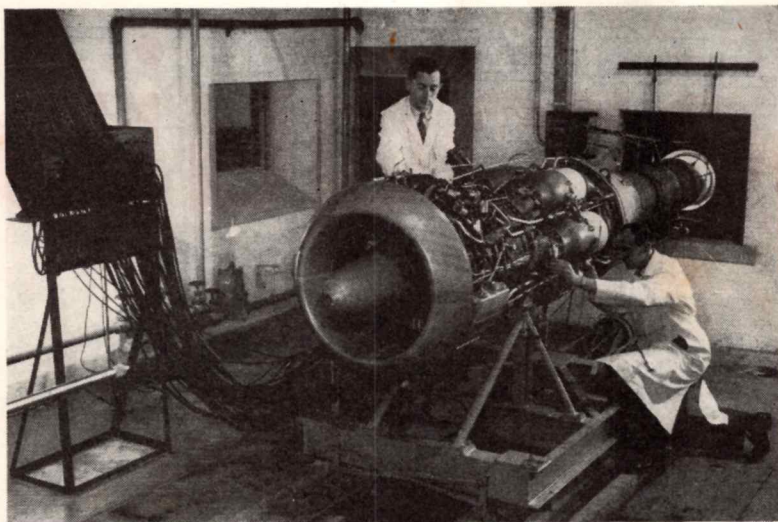
The *Chinook* has the distinction of being one of the few axial-flow turbojets developed in the British Empire. The *Metrovick Beryl* has been the only other one announced so far. On the other side of the fence, among the turboprops, the picture is reversed, with only one or two employing cen-



Front view of the compressor casing on the AVRO "Chinook," Canada's first jet engine. The nine stages of stator blades, each one an airfoil, are clearly visible



Closed-circuit wind tunnel for all types of aerodynamic studies connected with the flow of air and gases through the engine



"Chinook" receiving final adjustments before test running. Maze of tubing and cables leads to control room on left; note observation window

trifugal compressors. The other two jet engines (both turboprops) produced by the Hawker Siddeley Group are the Armstrong Siddeley *Mamba* and *Python*, each utilizing an axial-flow compressor—thus making the jet products of the Group 100% axial-flow.

AVRO Canada is rapidly growing in importance among the manufacturers of aviation products in the Dominion. The company is actively engaged also in constructing a commercial jet transport for short to medium ranges, carrying 36 to 40 passengers at 400-mph cruising speeds. This prototype is expected to fly early next year.

The jet-engine program was initiated at Malton during those uncertain stages of the war when British leaders decided that it was better to move some important development and manufacturing facilities off their island kingdom—just in case.

The facilities for the manufacture of gas-turbine components are set up primarily as an experimental factory. Huge production lines are not required at present, but rather a flexible organization capable of creating all parts of the engine and able to meet quick changes in design.

There are some 1700 compressor and turbine blades in each engine which have to be manufactured to extremely close tolerances. In many instances, AVRO has had to develop special equipment to manufacture these blades with the required precision.

It has been necessary also to establish special checking equipment for inspecting the parts. The facilities for carrying out various types of laboratory tests and for investigating new ideas are comprehensive and complete.

In an aerodynamic laboratory, sec-

tions of the engine can be checked for airflow patterns by actual air tests, or by electrical analogy. Electronic and vibration equipment are set up to carry out vibration and fatigue tests on turbine and compressor blades, to determine the number of times a blade can vibrate before failing, and to ascertain when and where synchronous vibrations occur.

An instrument laboratory is available for developing and calibrating special instruments used in the testing of engines and their components.

The bearings in a jet engine run under exceptionally difficult conditions, so a special laboratory is maintained for running bearings at high speeds and under varying conditions, with suitable equipment for closely gaging

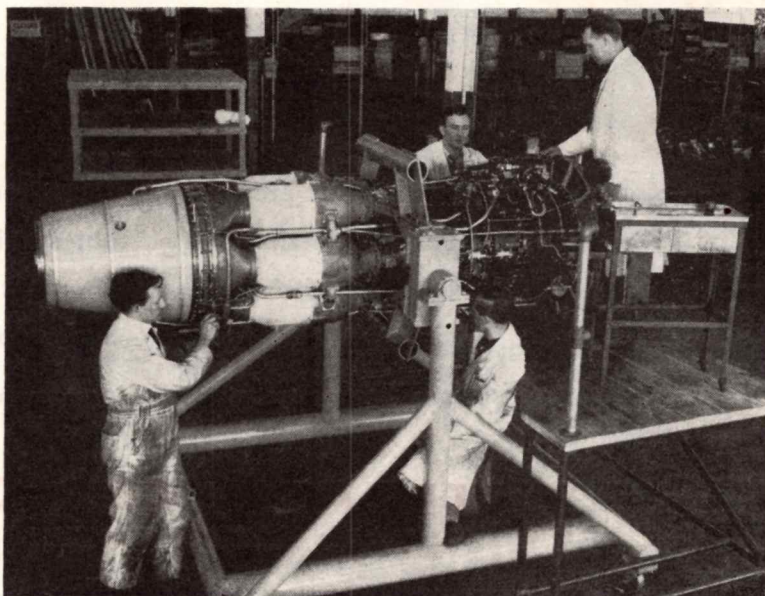
their performance in a wide variety of circumstances.

In a mechanical-test laboratory, compressor and turbine rotor assemblies can be run at very high speeds to confirm the correctness of the design. The tests are run in a steel-lined pit, sunk underground to protect the operators and to allow the bits and pieces to be collected should a blade fail.

An additional laboratory is set up for fuel and oil tests. Mock-ups of the fuel and oil systems are used to simulate running conditions and to check oil and fuel flow. Patternator and fuel-burner calibrating rigs are available also to determine types of fuel flow for various kinds of burner nozzles.

Situated several hundred yards from the main plant is an engine-test laboratory where completed engines are placed on the test stands and run. The instrumentation here is impressive for the engine test bed and its instruments supply many answers to the designers' problems.

In addition to the laboratories at Malton, there is another test facility at Nobel, Ontario. This plant was selected because of its powerplant equipment—a 6000-hp steam turbine, which is necessary for compressor testing. A number of large reciprocating air compressors, capable of supplying a substantial quantity of high-pressure air for combustion and aerodynamic tests, are also in operation at Nobel. The facilities are used in the testing and development of the three main components of the engine—compressors, turbines, and combustion chambers—and also for carrying out miscellaneous aerodynamic tests on sections of the engines.



Final assembly; fuel and oil lines receive a pressure test. Here engine can be swung 90° and is normally assembled in vertical position

Aeroquip

3,000 P.S.I. HOSE LINES AND FITTINGS*



100,000 IMPULSES AT 4500 P.S.I. PEAK

*An untouched photograph of one impulse
recorded on the Aeroquip Hydrauliscopes.*

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three pieces, each replaceable. Assembly without special tools. No tightening or adjustment after assembly. Fittings can be removed from hose and re-used over 100 times.

Aeroquip for better performance, maintenance and service.

**Another Aeroquip first*

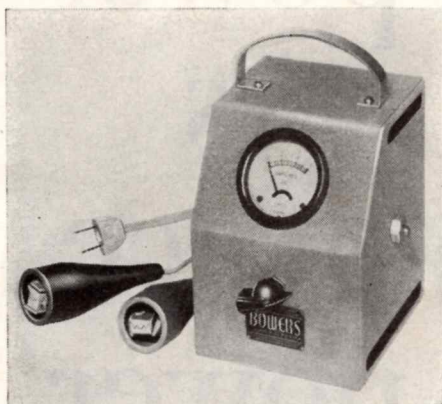
AEROQUIP CORPORATION
JACKSON, MICHIGAN

303 WAREHAM BLDG., HAGERSTOWN, MD. • 2912 N.E. 28TH ST., FORT WORTH, TEXAS • 1051 NORTH HOLLYWOOD WAY, BURBANK, CAL.
1419 2ND AVE. SO., MINNEAPOLIS 4, • IN CANADA: 72-74 STAFFORD STREET, TORONTO, CANADA

AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD



AERO EQUIPMENT and TRADE LITERATURE DIGEST



12-Volt Battery Charger

I-12

Designed to meet a definite need of the smaller maintenance shops and private aircraft owners, the Bowers unit charges one 12-v aircraft battery at a starting rate of 4 amps. Rheostat permits manual reduction of charging rate to 2 amps; operates on 115 v.

Bowers Battery & Spark Plug Co.
Reading, Penn.

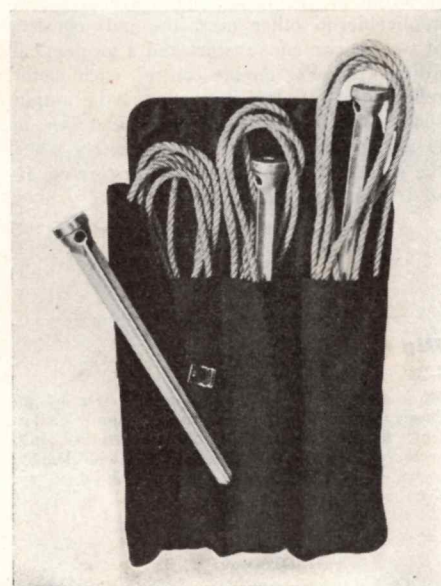
A vital information Service for the convenience of qualified personnel in the aeronautical industry. Additional information on the items in AERO EQUIPMENT AND TRADE LITERATURE DIGEST may be had by filling in coupon at left, clipping it to your company letterhead—and mailing it to AERO DIGEST.

Gravity-Pour Plastic Castings

I-15

Vespec is a thermosetting plastic from which castings are offered in varying degrees of plasticity, from quite hard to very flexible; available in colors, transparent, translucent and opaque. Eliminates the necessity for high cost molds and is especially suitable for short-run items not suited to expensive injection-type molds. Intricate pieces can be quickly cast; will take inserts; and is readily machined. Continuous high dielectric strength and performance is little effected by high or low temperatures. Produced from customer's model or blueprint; ideal for development programs where modification of design is often required.

Vespec Products Co.
Trenton Sales Office
2 Cole St.
Trenton, N. J.

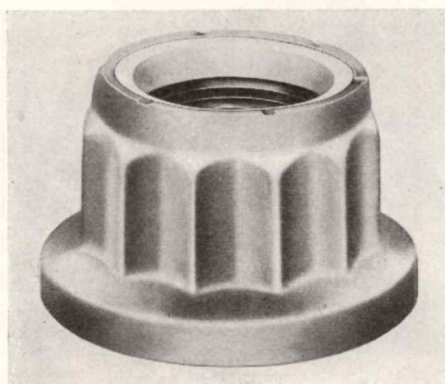


Lightweight Mooring Kit

I-14

Compact kit for securing lightplanes where they must be staked out. Weight is 4 lb, making for convenient carriage in baggage compartment. Outfit consists of three cast-aluminum alloy stakes and three ropes, packed in a sturdy bag. Stakes are 15 in long, with star drill points, for driving into frozen ground when necessary; ropes are 5/16-in No. 1 Manila, with a tensile strength of 1000 lb.

Air Associates, Inc.
Teterboro, N. J.



High Tensile Lock Nut

I-13

ESNA Type EB is a double-hex nut designed to develop 185,000 psi minimum in NAS high-strength aircraft bolts where weight and space limitations are major factors. Completely interchangeable with existing nuts and offers a height reduction of 50%. Features include: Nylon locking collar; forged steel body, cadmium plated; bearing surfaces square with thread axis; self-locking in any position. Available in National fine thread in sizes 1/4-in through 1 1/8-in.

Elastic Stop Nut Corp. of America
2330 Vauxhall Road
Union, N. J.

Flight Recorder

I-16

Continuous-strip instrument incorporating one to four moving-coil galvanometer writing elements. Meets specifications agreed upon by airline industry members; chart paper produces a direct record; paper is unaffected by light or time, will withstand 36 hr of submersion in sea water. Geared for speeds of recording time of 3 1/3 hr, 2/3 hr and 8 min with a 200-ft roll; other speeds can be provided.

G. M. Giannini & Co., Inc.
Pasadena, Calif.

(Continued on following page)

Write number
of item here

Name

Company

Address

..... Title

AERO DIGEST, New York September, 1948

Write number
of item here

Name

Company

Address

..... Title

AERO DIGEST, New York September, 1948

Write number
of item here

Name

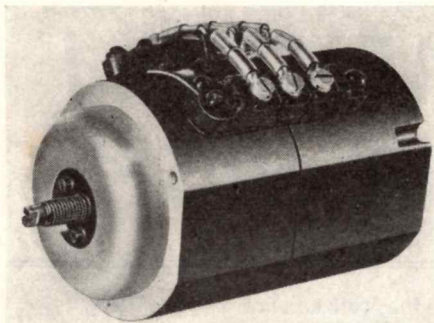
Company

Address

..... Title

AERO DIGEST, New York September, 1948

(Continued from preceding page)



Synchronous Differential

I-17

Used in engine synchronizing, the Kollsman Differential serves as an intermediary regulating device of engine control equipment. A torque-producing half-speed synchroscope, applicable to other uses, the unit consists of two synchronous motors and a mechanical differential. For engine control, each motor reflects the speed of one engine; the output shaft rotates at one-half the difference in motor speeds and becomes stationary when the speeds of the hysteresis motors are equalized. The unit weighs 28 oz.

Kollsman Instrument Div. of
Square D Co.
80-08 45th Ave.
Elmhurst, N. Y.

Dip Cleaning Machine

I-28

Magnus *Krazy-Dip* washes metal parts of all description by giving extra agitation. Turbulent, flowing cleaning solution is forced into recesses and hard-to-reach points. Cold cleaner; operates off a minimum air pressure of 50 psi—no other power required.

Magnus Chemical Co., Inc.
Equipment Division
Garwood, N. J.

Fast-Acting Paint Remover

I-29

By inhibiting evaporation, *Paint Lift* is said to penetrate more thoroughly. Safe on all metals; will not blister skin; is non-toxic, non-corrosive and non-inflammable.

Kelite Products, Inc.
Box 2917, Terminal Annex
Los Angeles 54, Calif.

Plastic Aircraft Coating

I-30

Molyclad is designed to retard staining by rain, corrosion, surface oxidation and tarnishing of *Alclad* surfaces. Material is transparent and provides a non-yellowing film, free from abrasives, acids and alkalis. Not a paint and not recommended for spraying; is wiped on with a lint-free cloth.

Sherwin-Williams Co.
101 Prospect St.
Cleveland 1, Ohio

Detergent-Dispersant Engine Oil

I-31

Gulfpride Aviation Oil—Series D is recommended only for horizontally-opposed engines used in lightplanes. It is formulated to clean dirty engines and to keep them clean, to free sticking valves and rings.

Gulf Oil Corp.
Gulf Building
Pittsburgh, Pa.

Portable Steam Cleaning Unit

I-21

Mechanical means of utilizing plant steam supply to furnish the proper amount of cleaning solution in a regulated flow, where it is mixed and delivered through a single hose to the cleaning gun. The Turco *Hydro-Steam* unit weighs 28 lb; is practical wherever a steam line pressure of 80 to 150 lb is available.

Turco Products, Inc.
6135 South Central Ave.
Los Angeles 1, Calif.

Metal Fabrication Facilities

I-22

Engineering and manufacturing facilities in precision metal fabrication which requires close tolerance standards. One example of a difficult operation successfully handled is the production of an aircraft engine intake pipe which required the forming and welding of different alloys in varying thicknesses.

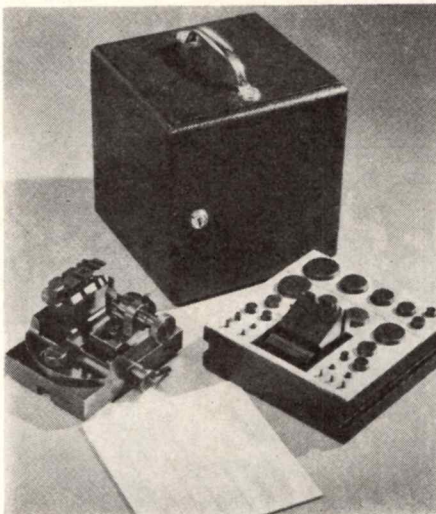
B. H. Aircraft Co., Inc.
Farmingdale, N. Y.

Electronic Computer

I-26

Office size unit capable of solving intricate aircraft design analysis and simulation problems; developed originally for the Office of Naval Research. May be used as a simulator to flight test a new design to evaluate the allowable range of design parameters without building experimental aircraft and conducting trial and error methods on them. May be used in the design of jet and reciprocating engines.

Reeves Instrument Corp.
215 E. 91st St.
New York 28, N. Y.



Thread Staging Fixture and Charts

I-19

The *See-All* fixture is a universal type for the inspection by optical comparison of screw threads ranging in diameter from .073-in to 1.00 in. Designed for use on AO Optical Projection Comparators, Kodak Contour Projectors, Jones and Lamson Optical Comparators and Model P25 Portman Comparators. Adapters can be supplied for its use on Bausch and Lomb Contour Projectors and certain other vertical types. "Normal to Helix" thread charts are available where gaging practice requires the staging of American National Form threads to the correct helix angle.

Engineers Specialties Division
980 Ellicott St.
Buffalo 8, N. Y.

(Continued on page 113)

Air power is peace power

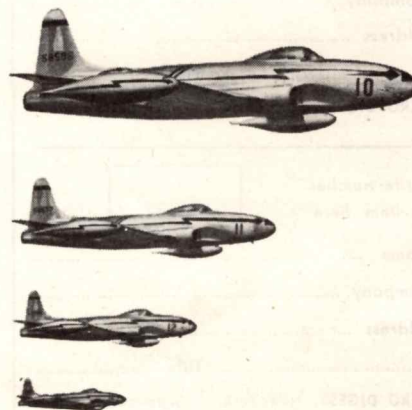
On Air Force Day, Sept. 18, Lockheed Aircraft Corporation salutes the men who fly to keep America strong.

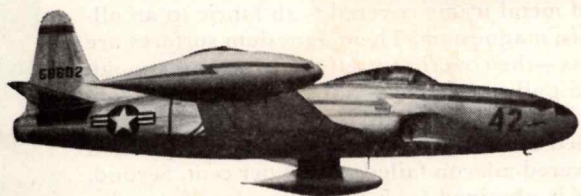
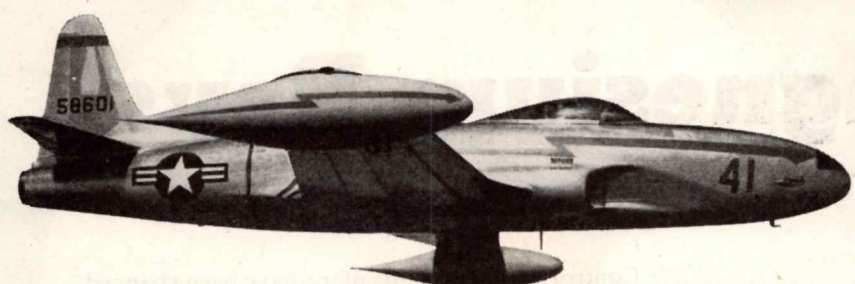
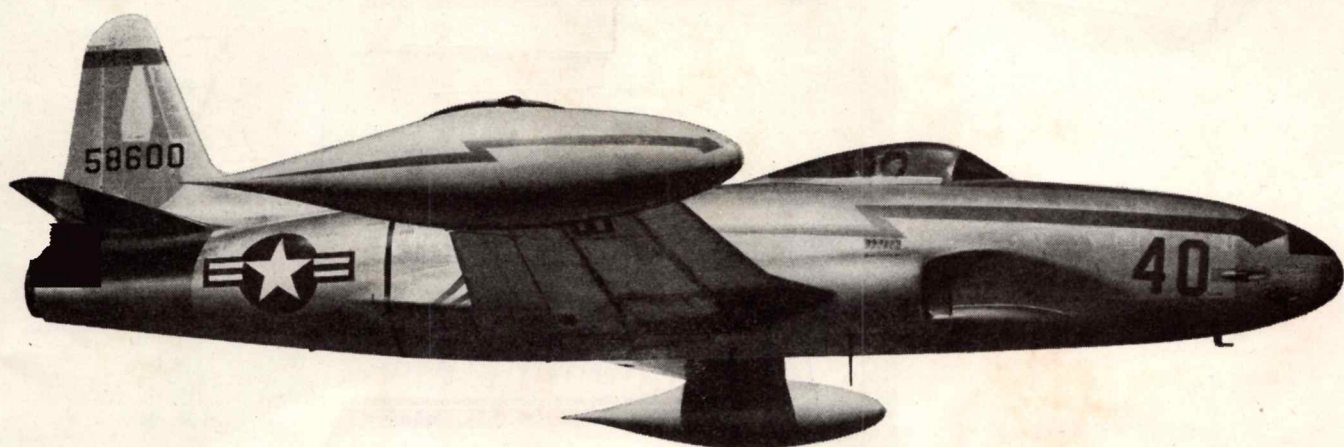
LOCKHEED

AIRCRAFT CORPORATION

BURBANK, CALIFORNIA

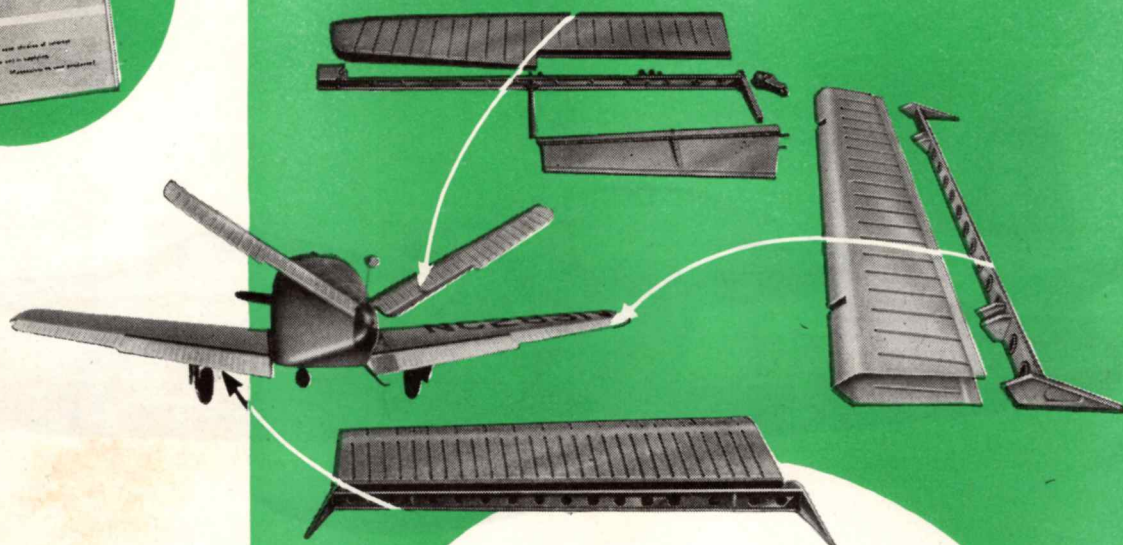
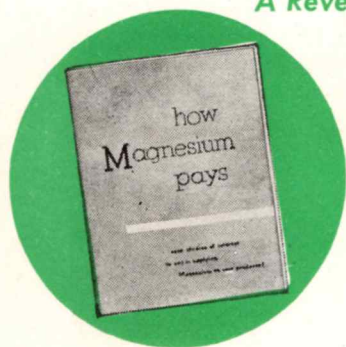
Look to Lockheed for Leadership





The Air Force F-80 Lockheed Shooting Star.

A Revealing New Book—Here's the inside story on how manufacturers of a wide range of products have found that it pays to use magnesium. It's a book of actual case studies of successful magnesium applications—a book that will be of direct interest to you.



How Magnesium Pays!

IN TRANSPORTATION EQUIPMENT

PROBLEM:

Light plane manufacturers and manufacturers of heavy transport and military planes face the same problem—producing the lightest possible structure strong enough to carry the load. In addition, men in the small plane field have the additional problem of selling the product at a competitive price. Their first objective is achieved by designing for lightness; their second, by using low cost materials of construction and simplifying manufacturing operations.

SOLUTION: Control surfaces on this plane have been changed from a complicated metal frame covered with fabric to an all-metal construction in magnesium. The magnesium surfaces are essentially frameless—the covering itself being strong enough to carry the load. Significant benefits have been derived from this change. First, ultimate strength is increased—the magnesium aileron failed at 210 per cent of ultimate design load while the fabric covered aileron failed at 150 per cent. Second, excellent stiffness is obtained from the torque box formed by the trailing edge skin, spar and end ribs. Third, construction is greatly simplified—magnesium saves 337 parts per ship, resulting in substantial savings in fabrication, assembly and tooling.

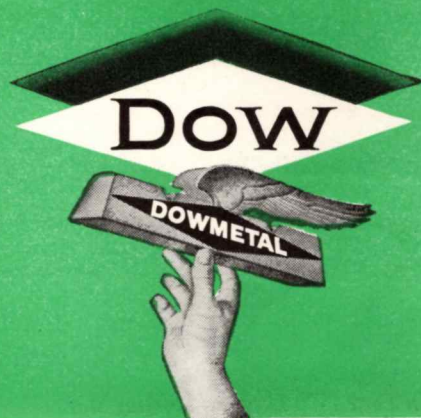
YOU, TOO, CAN MAKE MAGNESIUM PAY!

Magnesium pays for others—it can pay for you. Get the facts—send for this new study today.

Send me the study MP-66 "How Magnesium Pays" without obligation.

Name _____
 Title _____
 Firm _____
 Address _____

MAGNESIUM DIVISION • THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN
 New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
 St. Louis • Houston • San Francisco • Los Angeles • Seattle
 Dow Chemical of Canada, Limited, Toronto, Canada



(Continued from page 110)



Cherry Rivet Repair Kit

1-18

Especially designed for aircraft repair; all rivets are of oversize diameter to meet CAR. Equipment consists of 400 Cherry Rivets in two head styles, three diameters and various lengths; hand gun; stem trimmer; pulling heads; hole gages and twist drills. Packed in a sturdy wooden box.

Air Associates, Inc.
Teterboro, N. J.

Laboratory Press

1-23

The *Smooth Line* press enables the laboratory technician to do, briquetting, tensile testing, extracting, molding, laminating, compression testing and other operations along those lines. Can be used for production work.

Hydraulic Press Mfg. Co.
Mount Gilead, Ohio

PRE-TECH-TIVE

CORROSION PREVENTIVE BARRIER MATERIALS



TECH-WRAP... * The technically designed wrapper meeting all Grade A Type I or II Greaseproof Specifications. To prevent corrosion, the metal contacting surface is treated with an active inhibitor (D-30). Tough, durable, soft and pliable. Speedily wraps and molds itself to any shaped product needing greaseproof protection.

FOILTECH... The foil-backed Grade of TECH-WRAP. Has all the qualities of TECH-WRAP plus the qualities of Foil. Moisture-vapor-proof, waterproof and seals on twisting through its dead fold characteristics. Can be furnished single ply or duplex, or with heat-seal coating for absolute closure.

OTANACREPE... The neutral secondary wrapper available in light, medium or heavy-duty grades. Used as a cover for airplane motors to protect the Method II barrier material; secondary wrap to protect the primary wrap of Grade A material (TECH-WRAP); and used as narrow rolls to wrap coiled products spirally.

Prepare your product for shipment in these Technically designed PRE-TECH-TIVE Barrier Materials.

OTIS ANGLIER
AND
ASSOCIATES
CLEARWATER 6 FLORIDA

Please send me, without obligation, samples of PRE-TECH-TIVE products

Name _____
Street _____
City _____ State _____

Precision-Built Wood Propellers

1-24

Fixed-pitch wooden propellers for Piper PA-12 and PA-15 aircraft said to have more laminations of selected and specially seasoned wood. Resorcinol resins bond the laminations; dull black thrust faces eliminate glare; a new type impregnating varnish provides greater durability; tipping is stainless steel.

G. B. Lewis Co.
Watertown, Wisc.

Ground Power Supply

1-25

A 1000-amp, 28.5-V mobile rectifier, used as a power supply unit for starting jet engines and reciprocating engines of high horsepower. This is but one of a complete line of regulated rectifiers ranging from small to large, mobile or stationary—with either electronic controls or the newest magnetic amplifier control.

Industrial Electronics & Transformer Co.
1801 East Slauson Ave.
Los Angeles 11, Calif.

Valve and Tool Grinder

1-27

No. 6 Universal has a number and variety of adjustments. Flat head and 15° valves are handled without special attachments; valve stem capacity ranges from 1/4-in to 1 1/4-in and head capacity up to 5 1/4-in; rocker arms, valve stems and tappets are ground with the aid of standard attachments. Features air chuck and controlled-speed work head motor.

Black & Decker Mfg. Co.
Towson 4, Maryland

TRADE LITERATURE

See Instructions on Page 109 for
Obtaining Additional Information

Production Drilling Equipment

1-7

Bulletin illustrates and describes the *Quadri*, a four-position turret drill head which fits nearly all well-known drill presses. Also features a tapping installation and fast-acting "speed changer" for drill presses. A second bulletin describes the highly useful *Drillet* box jig for economical production drilling.

Chicago Drillet Corp.
1729 N. Winchester Ave.
Chicago 22, Ill.

Dial Gages and Indicators

1-8

Catalog No. 57 is a highly condensed, but useful presentation of dial indicators, dial measuring instruments and dial comparators. An almost unbelievable variety in models and sizes is available, in various sensitivities.

B. C. Ames Co.
61 Ames St.
Waltham 54, Mass.

Heat Transfer Products

1-9

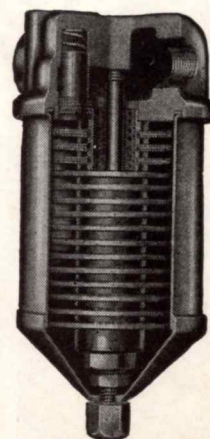
Catalog No. 148 features an entire line of radiators, intercoolers, convectors, heat exchangers, condensing and air conditioning units for aircraft, automotive and industrial uses.

Young Radiator Co.
Racine, Wisc.

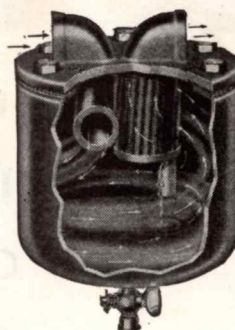
(Continued on following page)

As advertised in TIME and NEWSWEEK

From filtering jet engine fuel...



to cleaning compressed air...



put your filter job up to Air-Maze!

To keep trouble-causing dirt out of jet engine fuel is one problem—to remove water, dirt and oil from compressed air lines is another. But there's a special Air-Maze filter engineered to solve each of them—just as there are Air-Maze filters designed to solve scores of other filtration problems involving air or liquids.

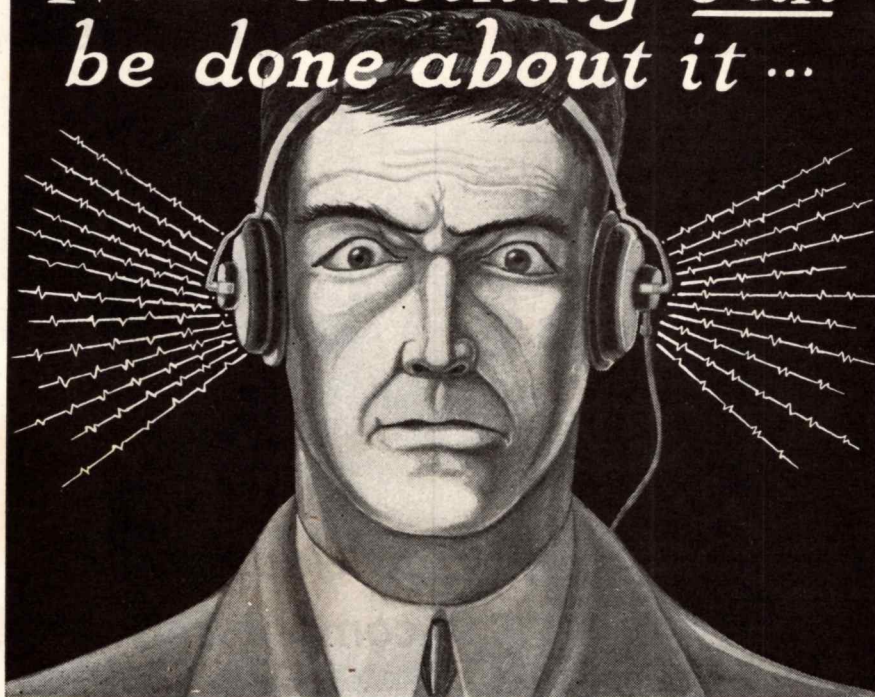
HAVE YOU A FILTERING PROBLEM? Whether you build or use engines, compressors, hydraulic equipment, lubricating systems, or any device using air or liquids—the chances are there is an Air-Maze engineered filter to serve you better. Write Air-Maze Corporation, Cleveland 5, O.

AIR-MAZE

The Filter Engineers

AIR FILTERS LIQUID FILTERS
SILENCERS OIL SEPARATORS
SPARK ARRESTERS GREASE FILTERS

Now something Can
be done about it ...



PRECIPITATION STATIC CAN BE MINIMIZED WITH THE

Completely New

Anstat

Aircraft Antenna Systems

Why let radio noise endanger the safety of your planes and passengers in flights through snow and rainstorms when Anstat Antenna Fittings will reduce this hazard?

Obtain safety plus economy by installing these completely new, polyethylene insulated Antenna Systems featuring time-saving positive connectors.

Fittings now available are Lead thru and Dead End Masts, Lead thru Insulators, Tension Units, Strain Insulators, Tee Splices, and Static Dischargers.

Write for descriptive bulletin.

ENGINEERING PHYSICS DIVISION

Fredric Flader, Inc.

NORTH TONAWANDA, NEW YORK, U. S. A.

Specify *Anstat* for Safer Flying

(Continued from preceding page)

Airmen's Supplies

I-1

Aeronautical books, airmen's equipment and air navigation supplies are listed in considerable variety in a 16-page illustrated catalog. CAA manuals, regulations, Army Tech manuals and general training publications are listed. Also includes watches, computers, maps, charts, cameras and projectors.

Pan-American Navigation Service
12021 Ventura Blvd.
North Hollywood, Calif.

Screw Thread Inserts

I-2

Bulletin No. 248 provides a wealth of information on design, specifications and installation data on *Heli-Coil* inserts for many uses.

Heli-Coil Corp.
47-23 35th St.
Long Island City 1, N. Y.

"Supersonic" Reflectoscope

I-3

Bulletin 3001 illustrates and describes the usefulness of this device for non-destructive testing and measuring on all kinds of materials. Shows applications of use from light metals to locomotive wheels.

Sperry Products, Inc.
1505 Willow Ave.
Hoboken, N. J.

Molybdenum Applications

I-4

Molybdenum: Steels, Irons, Alloys, is a \$90-page book discussing the varied applications of molybdenum as an alloying element. Major emphasis is placed on presentation of fundamentals; considerable recent information is included. Available free of charge to metallurgists and others closely connected with the industry. Ask for it on a business letterhead.

Climax Molybdenum Co.
500 Fifth Ave.
New York 18, N. Y.

Scientific Vibration Control

I-5

Vibrashock, engineering catalog, is filled with text and illustrations describing the six basic modes of vibration and sample types of suspension units to overcome them. Engineering services are offered.

Vibrashock Div.
Robinson Aviation, Inc.
Teterboro, N. J.

Aircraft Tire Handbook

I-10

A merchandising manual which explains General's "shock absorber" construction and describes its various products. Filled with size information and valuable tips on tire and wheel care.

General Tire & Rubber Co.
Akron, Ohio

Clips and Clamps

I-11

Catalog with engineering drawings and information on angle bracket clips; bonding, supporting and cushioning clamps; and multiple block-type clamps.

Thomas Associates
209-11 W. Palm Ave.
P. O. Box 629
Burbank, Calif.

EDITORIAL

(Continued from page 5)

of scarcity, the man who killed off the little pigs and plowed under the cotton and corn is in the place of power; the whole economic structure trembles . . .

"What a travesty on 'government by the people' was enacted in the letter that was so 'difficult to write'—the letter in which our Chief Executive attempted to justify his wretched act by telling Jesse Jones, 'It's not for lack of appreciation for all that you have done' . . . but 'Henry Wallace deserves almost any service which he thinks he can satisfactorily perform.'

"How do you members of the aeronautical industry like the idea of having your whole destiny placed in the hands of a Secretary of Commerce who will stop at nothing to do what one of his fellow-travelers calls 'Making America Over'?"

"Did you, too, 'display the utmost devotion to our cause' in the last campaign? Or are you what Wallace calls an 'American Fascist'—too busy with war work and with your troubles with the CIO to give politics much thought?"

"Your answer is important, for our troubles are deep-seated. The President of the United States has created a Frankenstein's monster by his truckling to the irresponsible left-wingers from whose clutches he never more can escape."

End quote.

If the Congressional Un-American Activities Committee had gone to work on the White House at the time of its appointment, we might have eliminated the Red catastrophe now existent in Washington. We live, but do we learn?

I wonder.

—F.A.T.

NEW YORK RADAR

(Continued from page 104)

This site at Mineola, Long Island, was chosen because it was located a short distance from famous Roosevelt Field and near the New York metropolitan area. After an interim period, during which the Lab was under the sponsorship of American Airlines, AIL was taken over by Aeronautical Radio Inc., which, in turn, is controlled by the scheduled airlines of the United States.

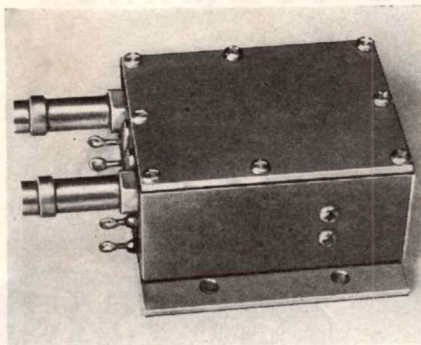
Thanks to continuing projects from the Navy, Army, and Air Force, from the Air

FOR AERONAUTICAL INSTRUMENTATION

Specify



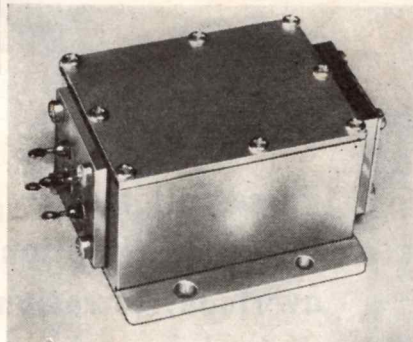
ELECTRICAL INSTRUMENTS



• PRESSURE PICKUPS

DIFFERENTIAL PRESSURE IN
RANGES FROM ± 10 TO ± 50 PSI

GAGE PRESSURES IN
RANGES UP TO 5000 PSI



• ACCELEROMETERS

RANGES FROM ± 10 TO 200 G's

High accuracy low cost instrumentation occupying a minimum of space can be achieved with these bonded strain gage type instruments. Strain gages arranged to complete the four arms of a Wheatstone bridge circuit yield full scale output up to 90 millivolts (open circuit). Functions can be measured with accuracies better than 1% of full scale. Altimeter, indicated airspeed instruments and other specialized aeronautical strain gage equipment can be furnished to specification. AC or DC operation.

*TRADEMARK

WRITE FOR DESCRIPTIVE BULLETINS

TELEFLIGHT INSTRUMENTS MANUFACTURED UNDER
BALDWIN LOCOMOTIVE WORKS LICENSE FOR AIRCRAFT USE

ENGINEERING PHYSICS DIVISION

Fredric Glader, Inc.

North Tonawanda, New York, U. S. A.

ACRO

MODEL M

The thinnest switch made...

★ ★ ★

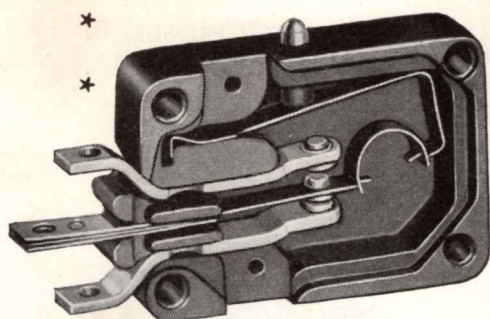
★ ★ ★

Now approved by

AIR MATERIEL COMMAND

★

★



Photos approximately 1½ times actual size. Bakelite case is 9/32" thick, 1 13/64" long and 53/64" high.

★

★

★ ★ ★ ★ ★ ★ ★

Passes all tests including vibration, overload, corrosion—resistance, temperature and humidity

Satisfactorily meeting the qualification requirements of Specification AN-S-39B, ACRO'S Model M Snap-Action Switch, Code No. 2MD3-1A, is now available for use on Air Force equipment.

This is the *thinnest* switch made—hence extremely light in weight and tiny enough to be installed where other switches will not fit.

Electrical tests passed at 27 ± 3 Volts DC include the following:

Motor load circuit capacity—make 36 amps, break 6 amps for 25,000 cycles.

Resistive circuit capacity—make and break 10 amps for 25,000 cycles.

Inductive circuit capacity—make and break 6 amps at 50,000 ft. alt. for 25,000 cycles.

ACRO'S exclusive rolling spring principle makes it possible for this "mighty midget" switch to deliver long dependable service with the utmost accuracy. Write for details on this, Model M and other approved ACRO Switches.

THE ACRO ELECTRIC COMPANY
1315 SUPERIOR AVENUE • CLEVELAND 14, OHIO

Transport Association, from the builders of aircraft and communications equipment, the broadcast industry and others, AIL has been able to recruit and hold scientists and engineers who are experts in the fields of radar and air navigation, transmitters, antennas, receivers, countermeasures, radiation and propagation, and the design and development of special electronic instruments. More than one and one-half million dollars' worth of work in these fields was completed during 1947.

The building of special electronic instruments for sale in the commercial market is the last step in the development of the Laboratory from a quasi-governmental research establishment to a self-supporting member of the business community. Its first commercially-available product, announced in December, is a versatile "polar recorder," designed to chart in one very usable form radiations of many forms of energy. It was first built to meet the Laboratory's need of an instrument to test the efficiency of special radio antennas for high-speed planes. Other devices, instruments devised in overcoming special problems encountered in the Lab's own work but usable by other laboratories and research groups in application to varied problems, will be announced within the next few months.

But, while AIL may turn some effort to the introduction of these new devices, its management has not lost sight of the primary purpose for which this post-war organization was established—the pursuit of research for the Armed Forces and industry.

Planning provides for covering those facets of the broad National electronics research program which may be overlooked by longer-established or more-specialized members of the industry. They anticipate a searching-out of "gaps" in research as thoroughly as their New York radar searches out aircraft in its portion of the sky.

Aeronca Price Cut

John A. Lawler, President of the Aeronca Aircraft Corporation, cites new FAF list prices, the company's first post-war price reductions, on three of its 1948 models.

The 4-passenger *Sedan*, 145 hp, is now \$4395; *Super Chief*, 2-place, side-by-side, 85 hp, lists at \$2585; new 85-hp *Champion*, 2-place tandem, sells at \$2495.

Antarctic Air-Defense Base

Work has begun on the new airport "Llanherne," 10 miles northeast of Hobart (Tasmania).

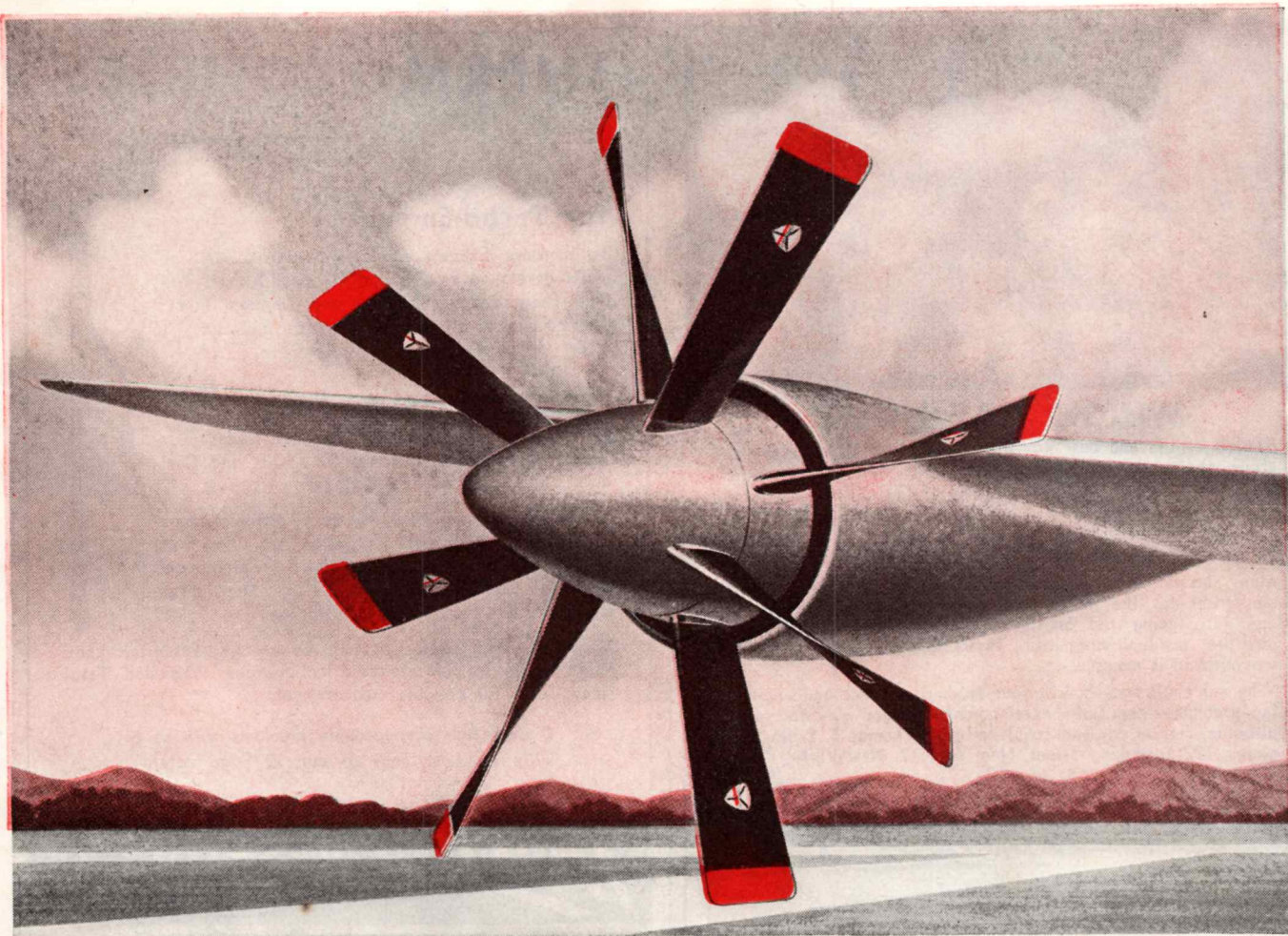
This great field will be built to handle the biggest military and civil types of aircraft now in use, and has been designed as Australia's key Antarctic-defense aerodrome.

All main approaches will be over water. Estimated cost, £760,000 (\$2,432,000). It is due for completion by 1951.

Early Birds Convene at Air Races

The Early Birds, organization of pioneer pilots who flew prior to World War I, will hold a big reunion in connection with the National Air Races, according to George H. Scragg, President.

Top even on their calendar will be the big EB banquet on Saturday, September 4.



Ready to Rise and Fly

The day of the turbo-prop dawns — a day which Aeroproducts research has been anticipating for many years. Aeroprop Duals are ready, the logical answer to turbine installations of great horsepower. They are ready with greater power absorption in practical diameters — with minimum weight for large installations — with balanced gyroscopic and torque effects.

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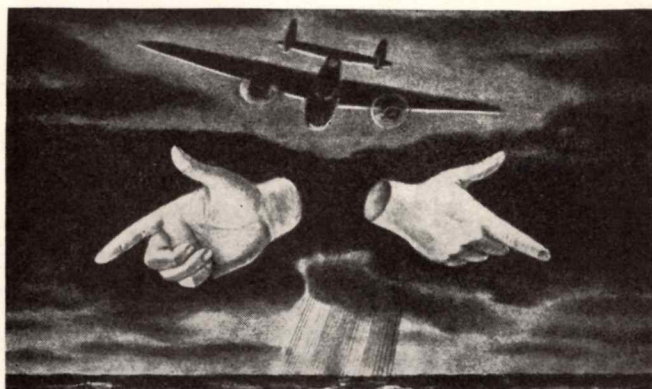
 
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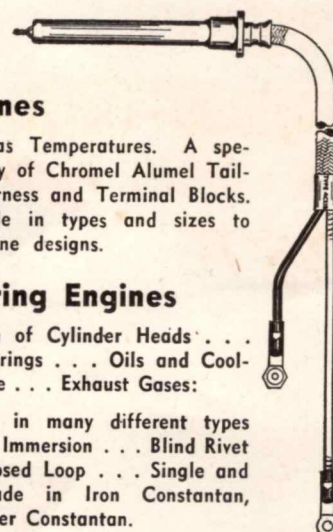
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• B. M. BROWN has been made Westinghouse Electric's assistant transportation manager.

• WILLIAM E. DIEFENDERFER has been named a chief design engineer by Hamilton Standard.

• WILLARD H. DOW, president of Dow Chemical Co., has been elected to receive the American Society for Metals' Medal for the Advancement of Research.

• WALTER L. FLINN has been appointed application and sales engineer for Vickers Inc.

• COL. JAMES M. GILLESPIE, chief of the Air Force All-Weather Flying Division until his retirement in May, has joined Garrett Corp. as assistant and technical advisor to the president.

• ROBERT C. LANDON has been named manager of industrial re-

Names in the News

*Personnel changes and promotions
in aviation and allied industries*

lations of the Rohm & Haas Co. and the Resinous Products & Chemical Co.

• HOBART C. MCDANIEL has been made manager of the technical press service of Westinghouse Electric Corp.

• FRED T. MILLER, west coast sales representative of Adel Precision Products Corp., has been appointed sales manager.

• HAROLD MONTEE, Washington representative of Seaboard & Western Airlines, has been elected a vice president.

• WHITLEY B. MOORE, director of sales for Timken Roller Bearing Co., has been elected vice president in charge of sales.

• EDWARD MOSEHAUER has been appointed a chief design engineer for Hamilton Standard

Propellers.

• MARK E. NEVILS, who was publicity director of Curtiss-Wright Corp. before joining Eastern Air Lines as news bureau director, has returned to Curtiss-Wright as public relations manager.

• E. B. NEWILL, general manager of the Allison Division of General Motors Corp., has been elected a vice president of the corporation.

• PAUL QUENEAU has been appointed metallurgical engineer of the International Nickel Co. of Canada, Ltd., and subsidiaries.

• ROBERT SCHOONOVER has been made advertising manager of Toledo Steel Products Co.

• HAROLD A. SHANK has been appointed manager of the air-

craft tire department of United States Rubber Co.

• EDWARD C. WELLS, formerly vice president-chief engineer for Boeing Airplane Co., has been made engineering vice president.

• KENNETH F. WHITFIELD, formerly assistant general sales manager, has been named advertising and sales promotion manager of Walker-Turner, division of Kearney & Trecker Corp.

• ROBERT D. WILLIAMS has been made personnel manager for Tinnerman Products, Inc.

• LYSLE WOOD, former assistant chief engineer for Boeing Airplane Co., has been made chief engineer.

• HARRY WOODHEAD, formerly president of Consolidated-Vultee Aircraft Corp., has been named general manager of Douglas Aircraft's new Metal Products Div.



Flinn



Shank

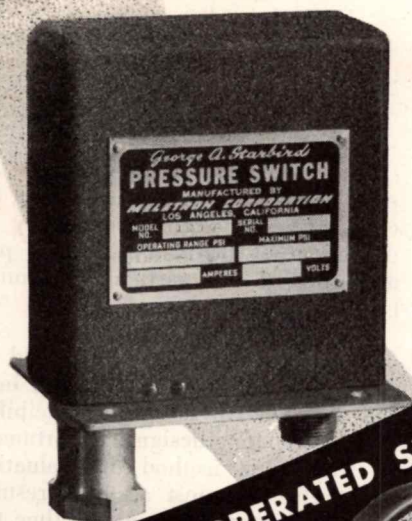


Woodhead



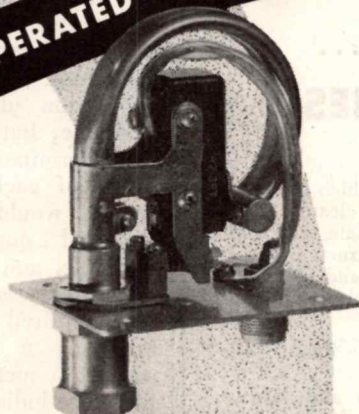
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DESIGN PRODUCIBILITY

(Continued from page 100)

Evaluation of Design Producibility

Just as it is necessary to evaluate the theoretical performance of alternative or competing design configurations, it is equally necessary that their design producibility shall be evaluated. This is a matter of supreme importance from the standpoint of national secur-

ity, and poses a difficult problem for procurement agencies. What would perhaps be an ideal method of arriving at a complete and accurate comparative evaluation of a number of proposals would require that the following data be available:

- (1) A complete set of detail, assembly and installation drawings for each design.
- (2) A standard set of tables giving:
 - (a) Time Standards (manufacturing hours for all typical operations).
 - (b) Labor Rates.
 - (c) Material, Standard and Purchased Parts, and Accessories Costs.
 - (d) Tooling Costs.

These standard tables would be applied to all designs, thus rendering the evaluation of design producibility independent of the manufacturing producibility of any particular organization.

With the use of such data, the cost of producing each airplane could be calculated, and these costs would indicate the relative design producibility of the competing designs. Unfortunately, while this method of evaluation might give the most accurate results, it is also impractical. At the time the evaluation is required, only a small proportion of the drawings will be available; but were they all available, the determination of the cost of every detail of each design under consideration would be a herculean task. Even if qualified personnel were available, and the expense of such an evaluation was considered justified, the time required would probably be prohibitive. A more practical, if less accurate, method of evaluation is therefore indicated.

The request for design proposals will usually specify the extent to which designs are to be delineated—by drawings, models, specifications, etc. It is then possible to determine which design-producibility principles may be sufficiently revealed by these data to warrant evaluation. The total number of points to be allotted to design producibility may then be distributed between these principles in accordance with what may be considered to be their relative importance. Each proposal may be examined for adherence to, or violation of, each of the selected design-producibility principles, and, in accordance therewith, points may be awarded under each principle in some proportion of the maximum allotment to that principle.

Such a method as that briefly outlined above depends for its successful application upon the experience and knowledge of those charged with its execution. However, assuming that a few engineers of suitable experience were to be assigned to this task, it is believed that, after a short time, reliable evaluations could be evolved with reasonable dispatch.

In the case of a design which is com-
(Continued on page 123)

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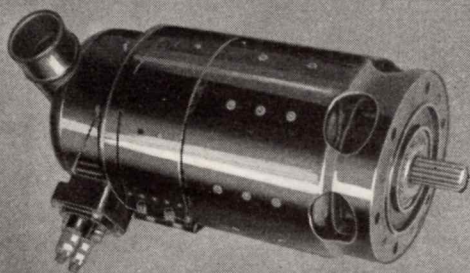
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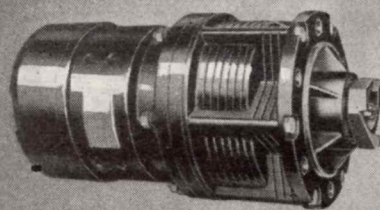
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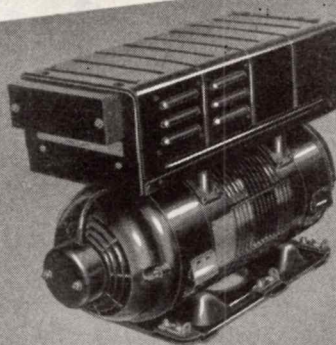
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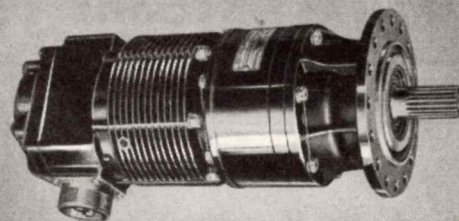
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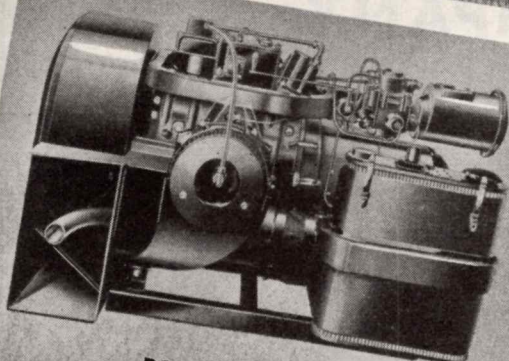
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(Continued from page 120)

pletely delineated, or of a completed airplane, the complete check list of design-productibility principles (given earlier in this article) may of course be used as a basis for evaluation.

In the preceding installment of the foregoing article, reference to *fig. 12* was inadvertently omitted. The context at that point should have read as follows:

"The number of parts required may be reduced by 'structural continuity'—incorporating a number of separate elements into an integral unit (*fig. 12*). The elimination of unnecessary splices in members is usually advantageous."

JET TRAINER FLIGHT

(Continued from page 42)

woods and farms. Each bit of landscape appeared clearly but was gone in a flash. Planes in the air seemed like moored balloons. It could be imagined how a fighter pilot, trained in this 2-place *Shooting Star*, could fix a plane in his optical gun sight. A touch of the trigger, setting off six .50-calibre machine guns in the nose, could blast an enemy.

We came at last down the long runway with a final snort and an easy touching of wheels.

"You've topped 600 miles an hour, true airspeed," Tony said with a grin. "That's something very few people can say."

On the ground, he gave me his book to sign. All I could think of writing was, "Wow, it was wonderful!"

—KENDALL HOYT.

General Tire Buys Marquardt

Controlling interest in the nation's foremost ramjet engine builder, Marquardt Aircraft Company of Venice, Calif., has been acquired by the General Tire & Rubber Co., according to a recent announcement by Dan A. Kimball, vice-president.

Marquardt Aircraft is engaged in the research, development, and production of jet-propulsion engines and is recognized for its outstanding progress in the development of ramjet engines.

Some details have been released on their C-30 unit, designed for a speed of 750 mph at sea-level (*Mach 1.00*), suitable for powering a large guided missile.

Hamilton Standard Changes

Hamilton Standard Propellers division, United Aircraft Corp., has announced a number of major personnel changes affecting factory and engineering departments.

Glenn L. Lampton, formerly Chief Experimental Engineer, has become Consulting Engineer for special studies on all types of propeller engineering problems. Ermano Garavanta has been promoted to Chief Blade Engineer. Sigmund A. Czarnecki has been transferred from Production Engineer to Master Mechanic, giving his full time to

production problems and special assignments.

Also, Charles B. Conwell has been transferred from engineering to the production department as Process Engineer, acting as liaison in matters concerning the hollow-steel blade. Edward M. Bancroft has been appointed Acting Production Engineer.

Federal Airport Program

Fifty-eight more grant offers totaling \$9,016,861 in Federal funds were made by the CAA to local sponsors between June 15 and July 15, 1948.

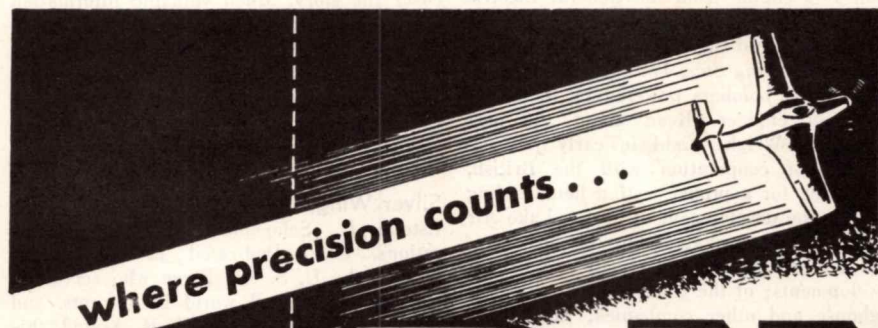
The latest grant offers were spread among 31 states and bring the over-all number to 389 for a total of \$45,229,007 in Federal funds.

Of the 389 grant offers to date, 108 are for the construction or improvement of small Class 1 airports; 95 for Class 2 fields; 110 for Class 3 airports; and 76 for the building or development of Class 4 and larger, or terminal-type airports.

New Tinnerman Factory

Tinnerman Products, Inc., Cleveland manufacturers of the Speed Nut spring-steel fasteners, are planning to build a new plant next year on a 32-acre plot of land purchased in the southwest section of Cleveland.

About one-third of the company's sales are to aircraft, business machine, farm equipment and other manufacturers. The new plant will increase output greatly.

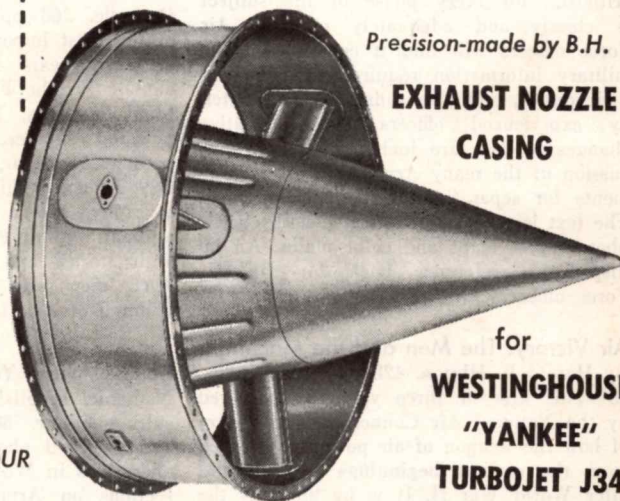


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Jet Propulsion Progress: The Development of Aircraft Gas Turbines. By Leslie E. Neville and Nathaniel F. Silsbee. 232 pp; bibliography; glossary of technical terms; international chronology; index. \$3.50.—In this new volume is told for the first time the complete story of the part played by the Air Force in jet powerplants and aircraft. The origins and step-by-step development of the latest GE-Alison J-33 engine from the General Electric I-16 and I-40 and the axial-flow J-35 engine from the General Electric TG-180 are traced; also the *Shooting Star*, *Thunderjet* and other fighters and bombers powered by these two great jet engines. Read about the part played by Wright Field in early jet pioneering, of cooperation with the British, the search for a proper testing field, ending up with the development of Muroc Lake Air Base, etc. Other chapters in the book provide a clear account of German and British developments; of the U. S. Navy, with Westinghouse and other companies; the NACA Gas Turbine committee and research work at Langley Field and Cleveland; present problems and future prospects. Favorably reviewed in the American and British aviation press. Over 90 illustrations. You will want this unique volume.

The Air Officer's Guide. 547 pp; illus; index. \$3.50.—The first military handbook dealing exclusively with the new United States Air Force. The treatment is beyond criticism, for every phase of the subject is clearly and adequately covered. Air Force officers will find it contains all the military information required to carry out their duties, and also sound advice written by experienced officers. All legislative changes to date are included, as is a discussion of the many Army-Air Force agreements for separation of the two branches. The text is profusely illustrated with charts, photographs, maps and color plates. An indispensable reference book for the Air Force officer.

Air Victory: The Men and the Machines. By Harold B. Hinton. 428 pp; illus; index. \$5.—This first of three volumes sponsored by the National Air Council tells the story of how the weapon of air power was forged from the earliest beginnings through and after World War II. It is by all odds the most complete popular history yet written of Army aviation up to the point of inauguration of the U. S. Air Force in the summer of 1947. The author, although active in both World Wars as an air officer, is a seasoned reporter on the staff of the *New York Times*, and he has written an intensely factual narrative. Combat operations in the war theaters are not included as they will be covered by two subsequent volumes. *Air Victory* is a book you will want to own.

Flying Minute Men: The Story of Civil Air Patrol. By Robert E. Neprud. 243 pp; illustrated, including several pages of cartoon strips by CAP-er Lt. Col. Zack Mosley; appendices; index. \$3.—Here is the complete and authorized story of America's Civil Air Patrol—a story of danger and sacrifice, of individual bravery and nationwide teamwork. Written by an ex-Air Force tech sergeant who traveled 5000 miles to uncover the story. Much valuable information was made available by Lt. Col. Kendall K. Hoyt, CAP recruiting and public-relations officer at National Headquarters, who worked out the highly successful teen-ager Cadet Corps program. Fills a much-felt gap in the U. S. air war story.

Silver Wings. By Edwin L. Wilber and Estelle R. Schoenholtz. 281 pp; decorations. \$2.50.—Dedicated to the gallant men of the U. S. Air Force who served so courageously on all world battlefronts, and with a foreword by Gen. H. H. Arnold, this book contains true stories of the heroes who gave our Air Force overwhelming power. In addition to the accounts of the exploits of our fighting airmen, there are stories of the men who planned the great actions that brought victory, the new methods of air combat they worked out, and the new weapons they devised.

They Tamed the Sky. By Douglas J. Ingells. Introduction by Lt. Gen. James H. Doolittle. 268 pp; illus. \$3.50.—Tells one of the most important and dramatic stories of recent years—the “miracles” that came out of Wright Field. “Pushbutton” flight, blind landings, high-altitude flight, high-powered engines, jet propulsion, rockets, parachute pumps, pick-up by planes, the B29, armament, high-speed high-altitude photography, and a host of others, with an authentic glimpse into the future. Packed with stories and anecdotes of many key AAF men who helped bring about the triumph of American aviation.

Bombs Away! Your Air Force in Action. Nathaniel F. Silsbee (Col., Air Res.), Consulting Editor. 386 pp; index. \$3.95.—An action-packed photographic history of AAF operations in World War II. Includes brief sections on Army aviation from 1907 to 1941; training; production and the Air Force of the future. Over 600 pictures, some in full color, including many of the finest photographs to come out of the war. Foreword by General Arnold, with special articles on various theatres and aspects of the air war by Generals Spaatz, Kenney, Eaker, Vandenberg, and many others, and by former Asst. Sec. Robert A. Lovett and Franklin D'Olier, Chairman, U. S. Strategic Bombing Survey. Full captions (supplied by consulting editor) provide a considerable body of

detail on the air war in every theater, covering action by pilots, aircrewmembers, ground crews, air-transport operations, etc. A perfect gift for any Air Force man, woman or family.

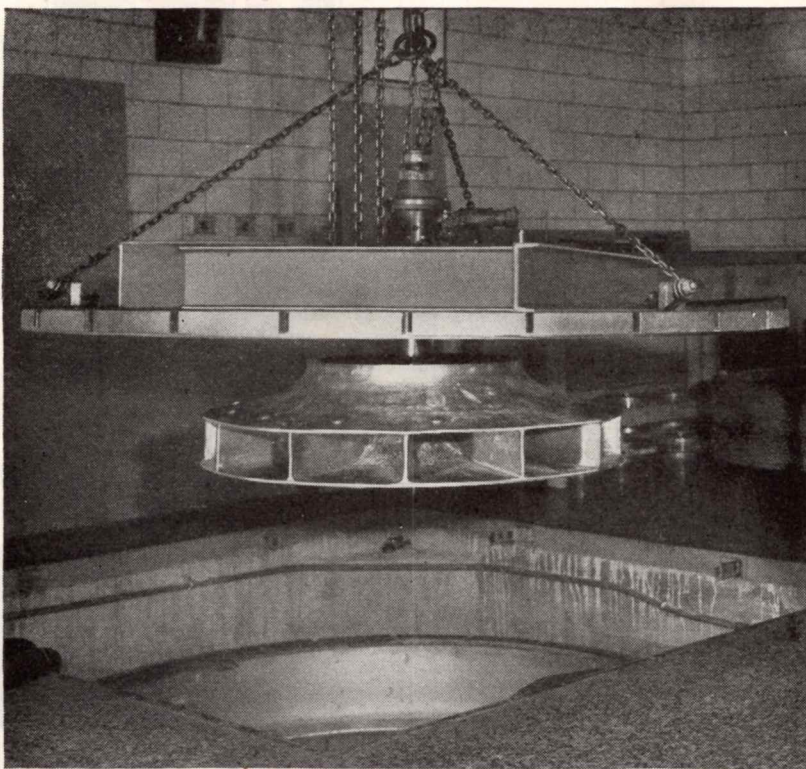
The AAF Against Japan. By Vern Haugland; 515 pp; illus; index. \$5.—An authoritative and intensely interesting account of all phases of the air offensive against Japan, written by a war correspondent who was with the AAF in the Pacific for more than four years. The book contains facts and figures about the air campaigns waged in the Pacific and Asiatic theaters, and includes heretofore restricted information. Full particulars are given about operations in Alaska, the southwest, south, and central Pacific, China, Burma, and India, and the incendiary and atomic bomb raids on Japan. There are personal stories of the airmen and accounts of the deeds of great flyers who died in action. Included are 24 pages of excellent illustrations. An inspiring story of the triumph of air power.

From Fiji Through the Philippines. By Lt. Col. Benjamin E. Lippincott and others. 193 pp; illus. \$10.—A series of 96 brilliant paintings accompanied by text portrays the life and activities of the Thirteenth Air Force in the offensive against Japan. Prepared by members of the historical section of the Thirteenth during actual operations this history reveals all important phases of one of the most colorful and outstanding operations of World War II. It shows how combat operations were conducted from the widely scattered island bases under adverse conditions. A description of the origin and formation of the Thirteenth is included. A magnificent permanent record of the Thirteenth Air Force.

The Army Air Forces in World War II (Vol. I). Edited by Wesley Frank Craven and James Lea Cate. 787 pp; illus; notes; appendices. \$5.—The first of a series of seven volumes which will constitute a comprehensive report on the activities of the AAF in World War II, prepared by the AAF Historical Division. This volume deals with plans and operations for the period from January 1939 to August 1942 particular attention being given to operations during the first eight or ten months of the war. The release of official enemy documents makes it possible now to expose the air strength and strategy of enemy air arms and thus to explain the difficult tactical demands of the early months of hostilities. An important historical contribution prepared by those in a position to supply factual information.

For reviews of books of technical and general interest see page 204

Impeller Whirled to Destruction!



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AIR views

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For, with the authorization by Congress of a 70-group air force, notice is served that this country is determined on a course of leadership in peace and freedom for people everywhere.

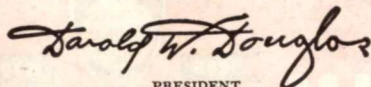
Here at Douglas—as in laboratories, drafting rooms, plants and on testing fields across the nation—developments speed this action of Congress.

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Newest in the Douglas family is the C-124. This giant all-purpose transport is designed to accommodate large ground force equipment. Two and a half times the size of the C-54, it will fly a maximum payload of 50,000 pounds 1,200 miles and return to base without refueling. Also now in work is the Douglas DC-6A—an all cargo version of the DC-6 passenger plane—capable of flying a 15-ton payload at 300 m.p.h.

As these projects go forward—together with our activity in guided missiles, rockets, supersonic jets, commercial and military transports—we of Douglas have but one single goal: effective aeronautical progress. To us this is the meaning of AIR FORCE DAY—every day!


PRESIDENT

DOUGLAS AIRCRAFT COMPANY, INC.
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SELLING TO USAF

(Continued from page 53)

materiel for stock are made out by the Air Materiel Command at Wright-Patterson Air Force base near Dayton, O. It issues contracts for aircraft and accessories, and it also is responsible for research and development contracts.

There are exceptions. For example, contracts for electronics research and development are handled at Watson Laboratories, Red Bank, N. J.

To facilitate procurement, the Air Materiel Command has been reorganized into seven branches, located at Mobile, Ala.; Middletown, Pa.; Ogden Utah; Oklahoma City, Okla.; Sacramento, Calif.; San Antonio, Texas; and Warner Robins, Ga. Huge warehouses and great repair depots are operated by these branches, and they constantly choose and requisition equipment and materials. There are other divisions in the overseas Commands.

The Air Materiel Command, however, is only one of 14 Commands which initiate purchases of equipment, supplies and services. They include the Tactical Air Command, USAF Headquarters Command, Air Transport Command, Air Training Command, Air University, Air Defense Command, Air Proving Ground and Strategic Air Command—all inside Continental United States. Five others are outside the country. They are USAFE—U. S. Air Forces in Europe; FEAFF—Far East Air Force; Alaska Air Command; Caribbean Air Command and the Pacific Air Command.

Buying orders are initiated at all the Command bases, supply depots, overhaul centers and operating facilities. Requirements vary in different climates and under different operating conditions. Many changes in equipment are dictated by experience in the field and at overhaul bases. There are emergency requirements.

Further, all Air Force bases, depots and other installations make "local" purchases, even through local merchants and jobbers. These "local" purchases embrace thousands of items, and range from metals, tools and materials to lights, medical and technical supplies.

From the above it may be seen that Air Force choosing and buying is carried on at all installations here and abroad. This creates problems for the supplier. His salesmen and other company representatives cannot cover the field thoroughly and keep it covered the year round. Supplier lists help, but they do not cover the market. Even when made up especially for one office handling certain equipment, they are like all other matter kept in the files. It is difficult to keep them up to date. Maintaining correspondence with buying personnel is effective in many cases; but not always, because of personnel changes.

The supplier, therefore, must be at pains to make his products known throughout the Air Force, and keep them known every day in the year.

Mac Short Dies

Mac Short, 51, vice-president of Lockheed Aircraft Corp., died August 13 at the Burbank factory following a heart attack. A veteran of more than 30 years in aviation, Short was one of the nation's outstanding aviation designers.

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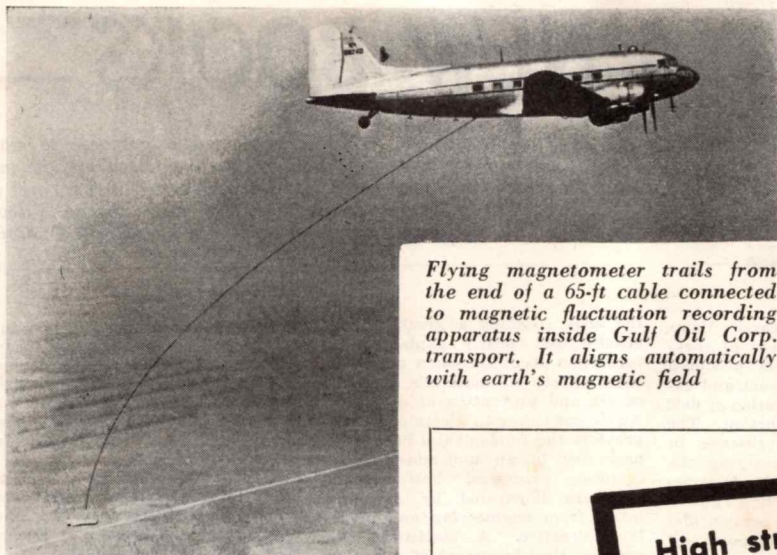


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Flying magnetometer trails from the end of a 65-ft cable connected to magnetic fluctuation recording apparatus inside Gulf Oil Corp. transport. It aligns automatically with earth's magnetic field

Flying Magnetometer Speeds Oil Search

KNOwn as an airborne magnetometer, housed in a bomb-like casing for aerodynamic purposes, a new tool has been developed by the Gulf Oil Corp. to speed geological surveys over regions of the earth normally considered prospective oil fields.

The principle behind the magnetometer is not new; but earlier efforts to make magnetic surveys from the air have met with only partial success. The Gulf unit is claimed to be successful, due in large part to its ability to orient itself automatically at all times so that it is in perfect alignment with the earth's magnetic field.

The magnetometer is trailed from an aircraft in flight from the end of a 65-ft cable. The varying intensities of the earth's magnetic field are measured and recorded inside the plane as it is flown carefully, at a constant altitude and over a charted area. The varying magnetic intensities revealed are later translated by geophysicists into magnetic contour maps.

These maps provide information concerning the rock structure of that area down to thousands of feet below the surface of the earth. On the basis of this information, the possibility of oil accumulations in the rock structure denoted can be judged.

The principal value of the magnetometer lies in the fact that large areas can be surveyed rapidly and in comfort. The nature of the terrain, whether jungle, water, swamp or desert, does not affect operations as they would when using surface transportation.

About the size of a cigarette, the heart of the unit is an element so sensitive that it measures changes in the magnetic field of 1 gamma—1/50,000th of the total field intensity. The measurements are sent back to associated equipment inside the plane through special conductors located inside the trail-cable. Gulf officials claim that the airborne magnetometer has put them years ahead of where they would otherwise be in their search for oil.

Continental Motors

Total engine shipments in the nine months ended July 31, 1948, amounted to 244,098 units against 169,695 in the corresponding period last year, a gain of 44%, it is announced by C. J. Reese, President of Continental Motors Corp.

This total included automotive and industrial engines, airplane, marine and small air-cooled units.

June shipments of aircraft engines were the largest since April, 1947, reflecting gradual improvement in the personal airplane industry. The figure for July showed a slight seasonal decline.

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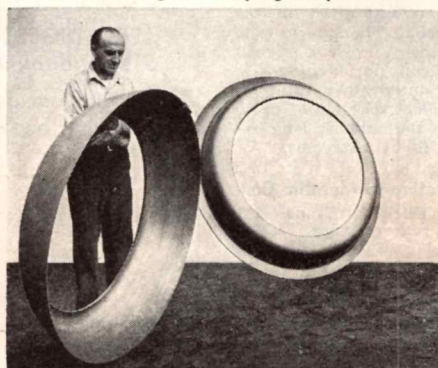
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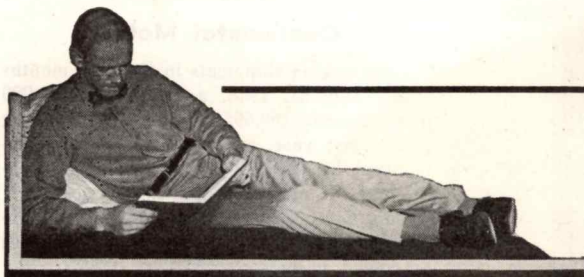
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Battlefronts of Industry. By David O. Woodbury. 342 pp; illus; index. \$3.50—Every page of this fast-moving account of Westinghouse in World War II is intensely interesting reading. While primarily the story of Westinghouse at war, it is to a considerable extent the narrative of all American industry during a vital period in our history, told by an outstanding writer and engineer who has the ability to describe intricate industrial problems and mechanical inventions in language that is both interesting and understandable to the average reader. It tells how America geared for war and how Westinghouse answered the challenge of national emergency. Of particular aviation interest are the sections on gas turbines and jet propulsion units, electropult plane launchers, deck-edge elevators for aircraft carriers, motors for operating wind-tunnel fans, and radar research. A graphic picture of how free enterprise can rise to meet a national emergency.

Aircraft Instrument Maintenance. By Earl F. Werner. 366 pp; illus; appendix; index. \$7.50—A very practical work on the operation, installation, and maintenance of all types of aircraft instruments including those for gliders. In writing this book the author's aim has been to present factual material and simplified explanations which will enable students, pilots, and airfield operators to acquire a thorough understanding of the subject with the minimum amount of effort. Information is supplied about the initial installation of instruments and maintenance operations involving removal, replacement, and reinstallation. There is a chapter for the advanced aircraft instrument maintenance mechanic which discusses field testing and describes portable testing equipment. An outstanding book in its field.

Introduction to Tool Engineering. By Halsey F. Owen. 149 pp; illus; index. \$3.60—This valuable contribution to texts on tool engineering deals with that phase of the subject called "manufacturing analysis." It has been written to provide the background of knowledge required by technical students in this field and to aid the practicing tool engineer. Information is supplied about procedures for the economical production of manufactured goods. Consideration is given to manufacturing equipment, parts analysis, designing for production, manufacturing costs, the economics of tooling, interchangeable manufacture, and other aspects of the subject. A book offering new approaches to manufacturing problems.

Rockets, Guns and Targets. Edited by John E. Burchard. 482 pp; appendices; personnel and subject indexes. \$6.00—An authoritative and instructive account of the work carried out by three divisions of the

National Defense Research Committee in the development of rockets, the study of effects produced by weapons through impact and explosion, and the investigation of field gun design and construction. The volume is one of the Science in World War II series covering the history of the OSRD. It describes the work of Divisions 1, 2, and 3 of the NDRC. The first section discusses solid fuel recoil weapons and related devices, the second terminal ballistics, and the third the control of gun erosion. A book of great historical and engineering interest.

Designs for Helicopters. By I. B. Laskowitz, Brooklyn, N. Y. 22 pp, diagrams, \$2.—The writer has given the problem of helicopter control, particularly on coaxial rotors, much thought. The booklet contains the author's patent specification and drawings of three different helicopter designs, with provision for manual and/or automatic means for changing blade pitch angle. Outline drawings show both variable-speed and variable-pitch controls.

The Ships and Aircraft of the United States Fleet. By James C. Fahey. 96 pp; illus. \$1.—"Victory" edition describes in exact detail the wartime expansion of the Navy, including its aircraft, aircraft carriers, capital ships, submarines, escorts, auxiliaries, landing craft and Coast Guard units. All the operational fighters, bombers, transports and special-purpose aircraft are shown in illustrations and described; also the blimps. An addenda brings both aircraft and surface vessel listings up to date as of April 1948. This useful book is profusely illustrated, thoroughly documented and contains a good index.

Meteorology: Practice Problems for Pilot Certificates. By E. C. Lambert. 19 pp; weather map, answer key. \$1.00.—The problems presented in this book have been carefully selected to familiarize the student with the material required for CAA pilot certificates and to drill him in the fundamentals of meteorology. They are intended for use in conjunction with a standard text on meteorology. The answers to all problems are given in the back of the book. The student who has worked these problems should have little difficulty in planning safe flights based on weather information. An excellent selection of problems based on the author's long experience as a flight instructor.

An Introduction to Metallic Corrosions. By Ulick R. Evans. 211 pp; illus, references; index. \$3.25—A book written with the object of fulfilling the need for a short text on metallic corrosion suitable for university courses and useful to scientists not versed in the subject. The author has succeeded admirably in accomplishing his objective, for

the book contains a great deal of concise and clearly explained information about corrosion processes, their effects on materials, and the causes and prevention of corrosion. An introduction to electrochemistry provides the fundamental knowledge necessary to an understanding of corrosion processes. Basic principles are illustrated by examples taken from engineering and industrial practice. A statistical and mathematical treatment of corrosion is presented in the concluding chapter. Both students and instructors will appreciate this thoroughly up-to-date text.

Aeronautical Training. By Charles A. Zweng. 444 pp; illus; \$3.00—A completely revised edition of a text which has been used with great success by those preparing to take government examinations for commercial and private pilots. The book has been enlarged by the inclusion of new material on the theory of flight, meteorology, and navigation. New sections cover the flight maneuvers required for flight tests and the examiner's methods of grading these maneuvers. Included in the section on Civil Air Regulations are all the latest amendments. An up-to-the-minute quiz system which is especially suitable for use in colleges that are now giving flight and ground instruction.

Flak Bait: The Story of the Men Who Flew the "Marauders." By Devon Francis; edited by Gordon Carroll, assisted by Betty John. 331 pp; illus; index. \$5.—In this exciting, fast-moving volume has been gathered one of the most interesting, readable and comprehensive narratives of aerial warfare yet to appear. Using official Air Force combat reports, first-hand observation, interviews with *Marauder* crewmen as well as top strategy planners, the author and editors have done three things remarkably well. They have told vividly the story of how the men in the bullet-shaped Martin B-26 bombers carried the fight to the enemy. They

have made to re-live for thousands of Air Force veterans, the heartaches and the laughs, the dangers and the discomforts, the victories and the despairs of the days from Pearl Harbor to V-E Day. They have, finally, pointed up the full pattern of Allied planning as it related to the strategic use of the B-26, especially in its great contributions to victory in the Mediterranean and western Europe. Very heartily recommended.

Metals Handbook—1948 Edition. Prepared under the direction of the Metals Handbook Committee of the American Society for Metals and edited by Taylor Lyman. 1444 pp; illus; index. \$15.—This comprehensive volume was designed to be a useful working whole—not merely a collection of technical articles, tables, data sheets and diagrams. Special guides and indexes to data sheets, phase diagrams, reference tables, Government specification numbers, etc. should be a help in this direction. There are four main divisions, including a General Section, Ferrous Metals, Nonferrous Metals and Constitution of Alloys. Under these four headings are listed 37 sections of the Handbook. All in all, this volume is the last word on metallurgy, and is of special interest to the aircraft industry.

Elementary Industrial Electronics. By William R. Wellman. 371 pp; illus; index. \$3.20.—This excellent introductory volume has been prepared to meet the needs of students, workers in the electrical and plant-maintenance fields, persons employed in other branches of electronics and all others who wish to become familiar with the basic principles involved in electronic equipment now in industrial use. The great strides taken in the industrial applications of the science of electronics during recent years have demonstrated that this versatile tool will probably be of great importance in increasing production. An especially useful chapter on Electronic Symbols and Terms has been included.

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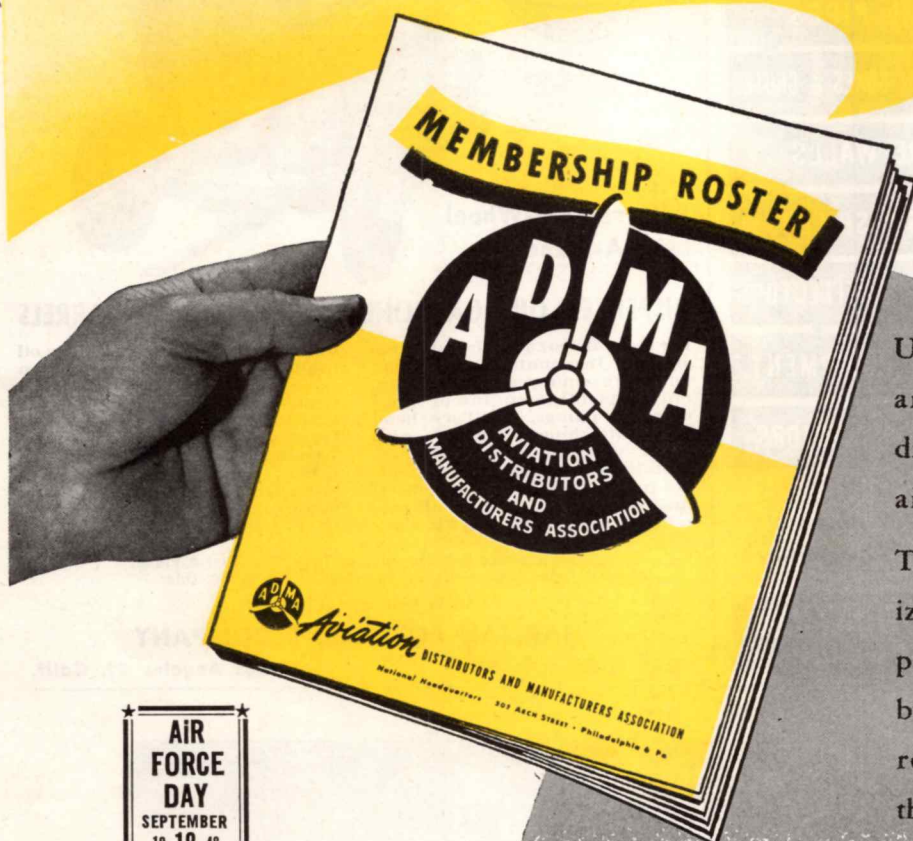
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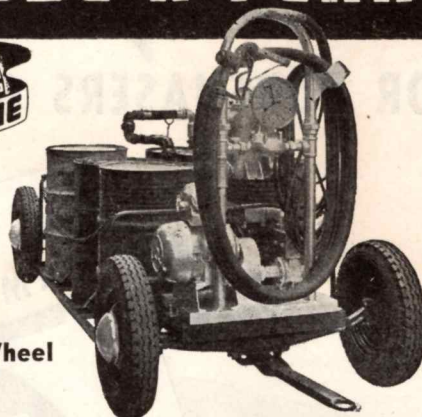
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The crews of Chinese river junks and the U. S. aircraft carrier "Valley Forge" are mutually curious as the carrier makes its way into Hongkong Harbor

Trainers to China

The Babb Company has sold the Chinese Air Force 200 North American *Harvard* training planes and 125 Pratt & Whitney engines as replacement units, Charles H. Babb, president, announces.

The company, one of the country's largest dealers in used aircraft, had bought most of the equipment at war surplus sales. After overhaul and reconditioning, the planes and engines will be shipped to China from West Coast ports.

New Parker Appliance Plant

Manufacturing facilities of the Parker Appliance Company's Pacific Division will soon be doubled by the Company's purchase of the Los Angeles plant of Air Associates, Inc. of Teterboro, N. J., according to a recent announcement of S. B. Taylor, Parker president.

It is a streamlined, single-story building of 42,000 sq ft.

AIR ELEMENT

(Continued from page 37)

in the many field exercises and maneuvers involving air transportability in which we participate with the Army Field Forces.

The Fairchild C-82 *Packet*, the principal troop carrier at present, is soon to be replaced with an improved version known as the C-119. The C-119, designed to carry a nine-ton load for a range of 2000 miles, can carry a larger load shorter distances. It accommodates 42 fully equipped combat troops and 20 parachute cans of supplies. This year we will start experimenting with the new track-type landing gear on troop carriers. This development points toward the day when tactical operations can be carried out from any level field, eliminating the necessity for smooth, hard-surface runways.

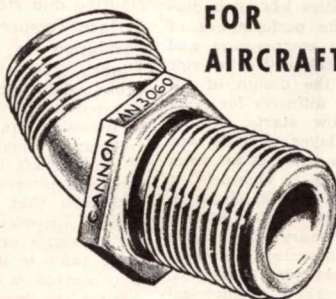
The principal combat weapon employed by TAC units is the fighter-bomber. The fighter-bomber is probably the most versatile of all air weapons. Equally at home in air-to-air battle and in dive bombing, strafing, and rocket attacks on ground emplacements, it performs a multitudinous variety of tasks. We came out of the last war flying P-51's and P-47's in this category. Today they are being replaced rapidly by newer jet models, and even our earlier jets will soon begin moving aside for more advanced designs.

The Lockheed F-80 *Shooting Star*, our first operational jet, has long been employed by TAC units. This year we will begin operating the North American F-86. The F-86, designed for speeds in excess of 650 mph, has

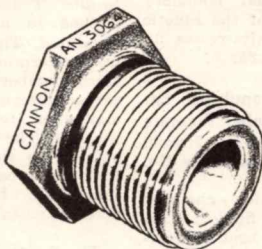
YOU CAN TELL THE QUALITY OF THE PLUG BY THE EQUIPMENT IT CONNECTS

Cannon Plug

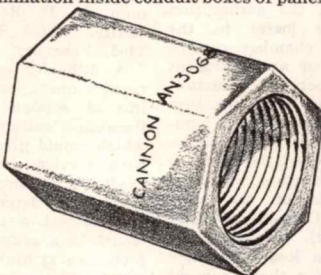
"AN" CONDUIT FITTINGS FOR AIRCRAFT



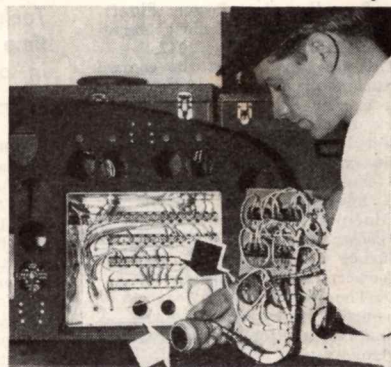
AN3060 45° CONDUIT COUPLING used for connecting either flexible or rigid aluminum, brass or other conduit.



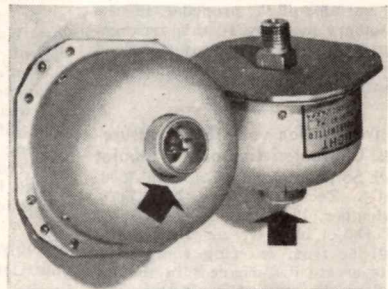
AN3064 BOX CONNECTOR used with AN3066 Conduit Coupling to form a termination inside conduit boxes or panel.



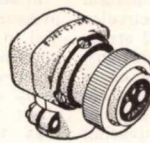
AN3068 CONDUIT COUPLING ADAPTER is used to make a coupling between any two male threaded conduit fittings.



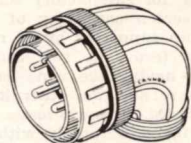
Mid-Continent Airline mechanic, S. M. Fabac, holding a Cannon Electric Type "K" Plug about to be installed in the instrument panel of an MCA airliner. Upper black arrow points to K-32S Receptacle. "Major timesavers", say Mid-Continent Airlines of Cannon Plugs.



Cannon Type "AN" Receptacles on G. M. Giannini & Co. High Pressure Transducers.



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Type "AN"

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Unless specific engineering bulletins are required, ask for C-47 Condensed Catalog giving a summary of the various type series and prices in many types. Address Dept. I-103.

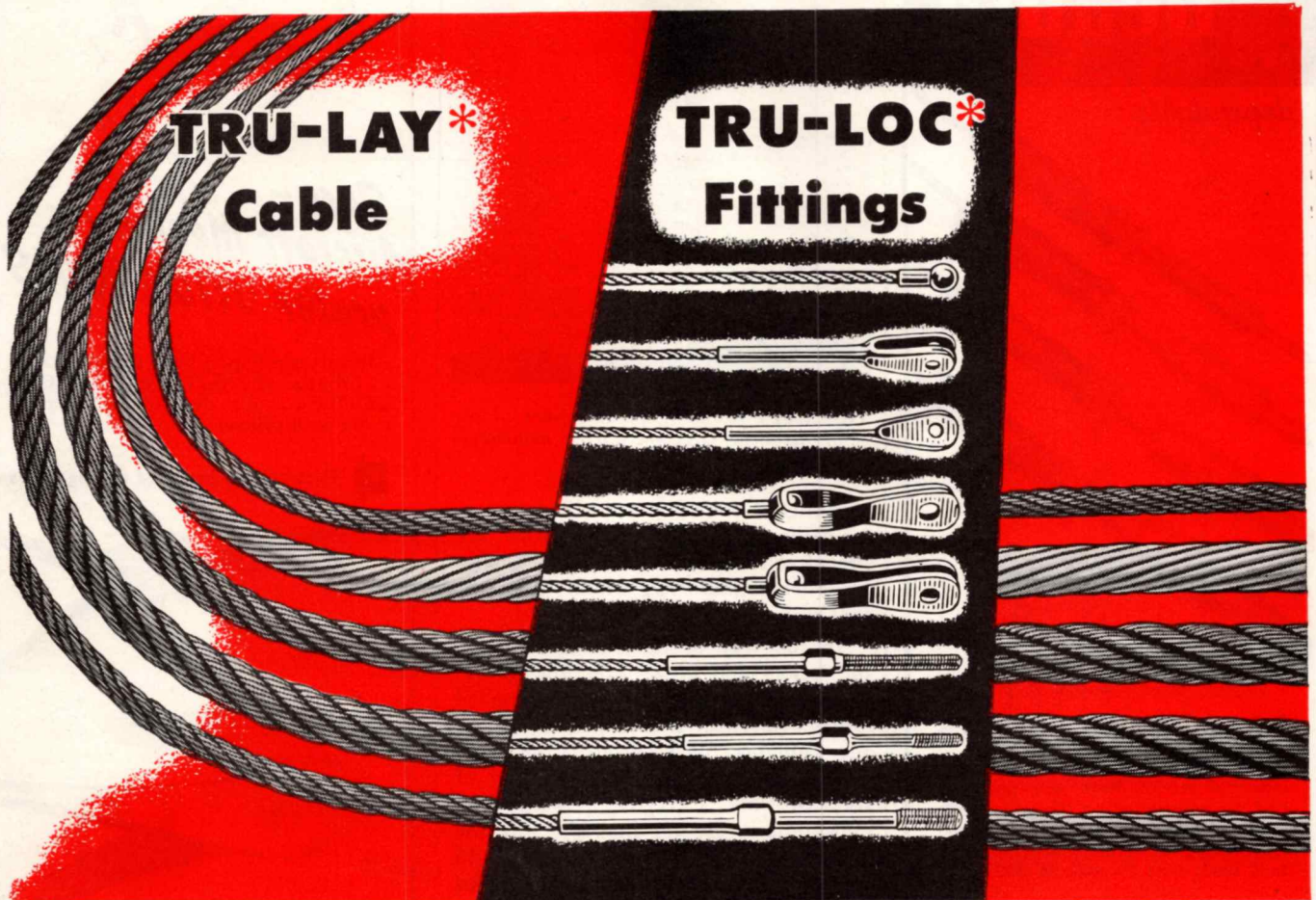


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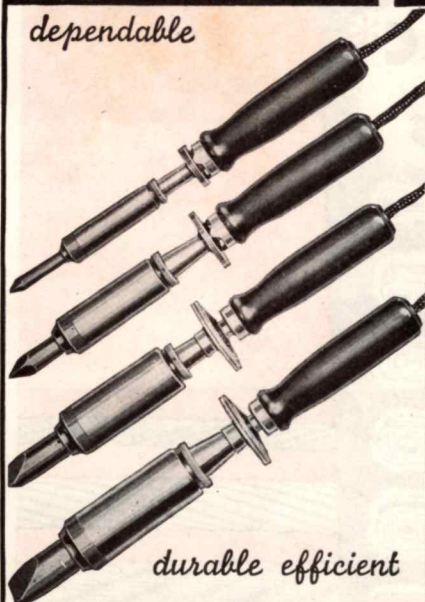
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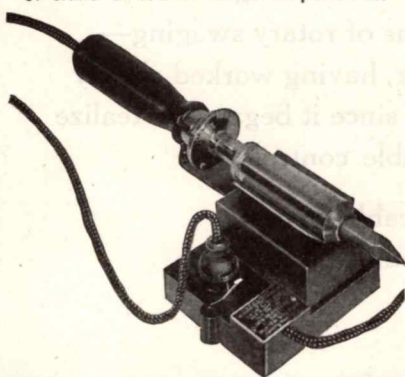
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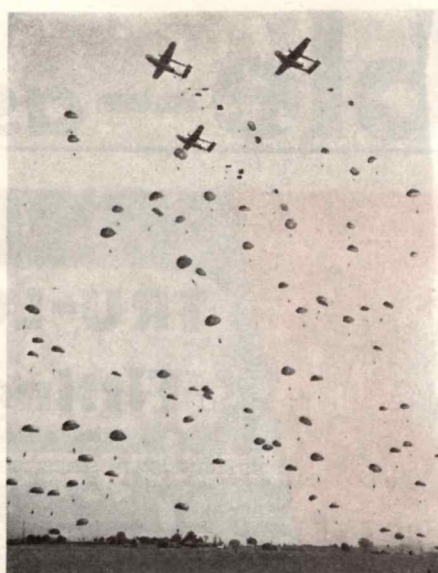
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In the way of light bombardment, our pilots and crews are now undergoing training in the new jet-propelled North American B-45. It is replacing the Douglas A-26 *Invader*, the most advanced attack craft to come out of the last war. Carrying a bomb load substantially greater than the wartime Boeing B-17 heavy bombers, the B-45 has a combat radius of over 800 miles and a top speed in the 500-mph class.

Our reconnaissance units are equipped with fighters and light bombers which carry cameras instead of guns. We have aircraft equipped for both day and night photography, whose usefulness in all phases of tactical air war is readily apparent.

Smaller Specialists

Some of the miscellaneous but equally important smaller units in the command include aircraft control and warning squadrons; photographic technical squadrons; signal battalions; radar-calibration detachments; motor-transport squadrons; shoran-beacon units; tow-target squadrons, and liaison squadrons.

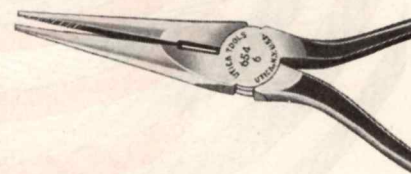
In our present training, while still faced with the unceasing problem of individual training, we are especially concerned with unit training. We insist that our flights fly as flights and our squadrons as squadrons. Our administrative and service elements are ready to move into the field on short notice and furnish support for the tactical organizations. Our units are con-



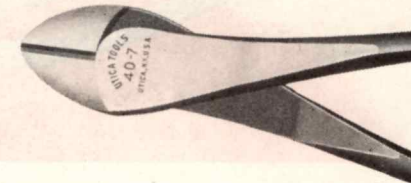
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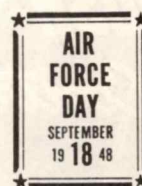
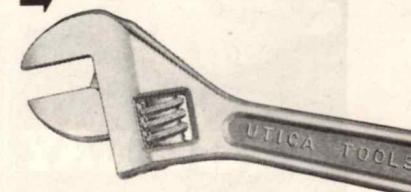
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stantly preparing for and engaging in field exercises and maneuvers in conjunction with the Army Field Forces. We have just finished Exercise Assembly, the largest joint exercise held since the war, and our plans for the coming year include exercises in locations extending from Alaska to Florida. The joint responsibility for these exercises is started in the planning stage and carried on throughout the entire operation.

If this nation should once again face the ordeal of war, the Tactical Air Command is ready to assume its share of the burden. Together with strategic air power, the Army and the Navy, we look to the future with assurance—with hope that the very fact of our readiness will help prevent another war, but confident that if it does not, we shall be able to carry our share of the load along the road to victory.

TRAINING COMMAND

(Continued from page 55)

niques with the use of the most modern equipment available. As a second mission, the school conducts formal research in the development of new techniques and procedures of instrument flying, and disseminates findings to all Air Force units. The B-25 aircraft is used in this program, permitting trainees to seek out actual weather conditions throughout the nation for a practical application of their studies. The course is ten weeks in length and includes approximately 110 hours of instrument flying.

Liaison pilots are trained for the Army at San Marcos Air Force Base, a sub-base of Randolph. Students are assigned to the school by the Army and are returned to field units upon graduation. Both the L-5 and L-16 aircraft are used for instruction. The station at San Marcos also conducts a helicopter pilot course to train Army pilots for the YH-13 Helicopter, and a similar course to train Air Force pilots for the H-5 Helicopter.

Williams Air Force Base conducts a fighter-gunnery training research-and-development program.

The Technical Division, Air Training Command, is currently operating more than 100 technical courses for the production of the many types of individual specialists required by the Air Force.

These courses, conducted at five Air Force stations, are established to meet definite qualitative and quantitative requirements and are operated in "family groups" to facilitate the supply of equipment and coordination of instruction. All communication courses,

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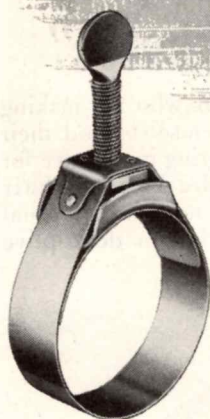


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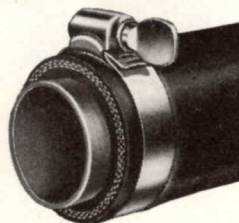
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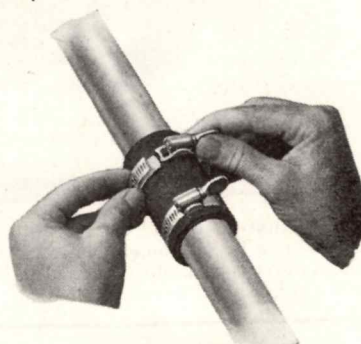


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for example, are located at Scott Air Force Base, Illinois. All armament and photographic courses are conducted at Lowry Air Force Base, Colorado. Other courses are similarly grouped.

During World War II, the immediate problem of technical training was to get the airman into an operational unit in the field in the shortest possible time, consistent with meeting the job requirements of his skill. This expediency led to a high degree of specialization. Aircraft mechanics, for example, were taught to maintain only one type of aircraft. Other personnel were taught equally narrow fields of skill. This method of training was expedient. It was also highly uneconomical, for if a man were transferred from one unit to another where he had to maintain or operate a different type of equipment or aircraft, a re-training process was necessary.

Background Knowledge

The postwar technical-training program is being generalized. Students are given a solid background of basic knowledge, studying all the common theories and principles of an entire vocational field and receiving training on typical equipment. They must learn to operate and to maintain any type of equipment that might be encountered in a normal-duty assignment in their specialty.

This method of training produces better qualified airmen. It is also more economical, obviating much of the necessity for re-training.

Technical courses of the Air Training Command are divided into two distinct groups. First, basic technical courses for the young officer or airman entering the Air Force provide instruction in a basic skill prior to assignment in the field. Second, the more advanced or "career" courses for the officer or technician who has had experience in the field provide opportunity for enhancement of knowledge, and opportunity for promotion as a result of a more advanced technical education. To enter these last-mentioned courses, the officer or airman must usually have a considerable background of on-the-job experience in the field.

Each station of the Technical Division operates a Training Development Unit for the purpose of keeping all courses abreast of the latest techniques and equipment. This unit sends key personnel on frequent visits to educational institutions, both military and civilian, to acquire knowledge of the latest instructional techniques and educational developments. Visits are made to factories where new equipment is being produced, and to the Air Materiel Command, where materiel de-

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signs and developments are studied. The first items of all new equipment are made available to the Air Training Command so that schools are kept abreast of materiel changes.

Both military and civilian personnel are utilized as instructors in Technical Division schools. All of them are well qualified in their professions and meet high educational standards.

The civilian cadre lends stability to the training program. The military cadre, coming from units in the field, provides the practical know-how for technical maintenance and operation. Course outlines and syllabuses are carefully studied by experts before the establishment of courses. Modifications are made on a continuing basis to permit the ready assimilation of new ideas and new equipment.

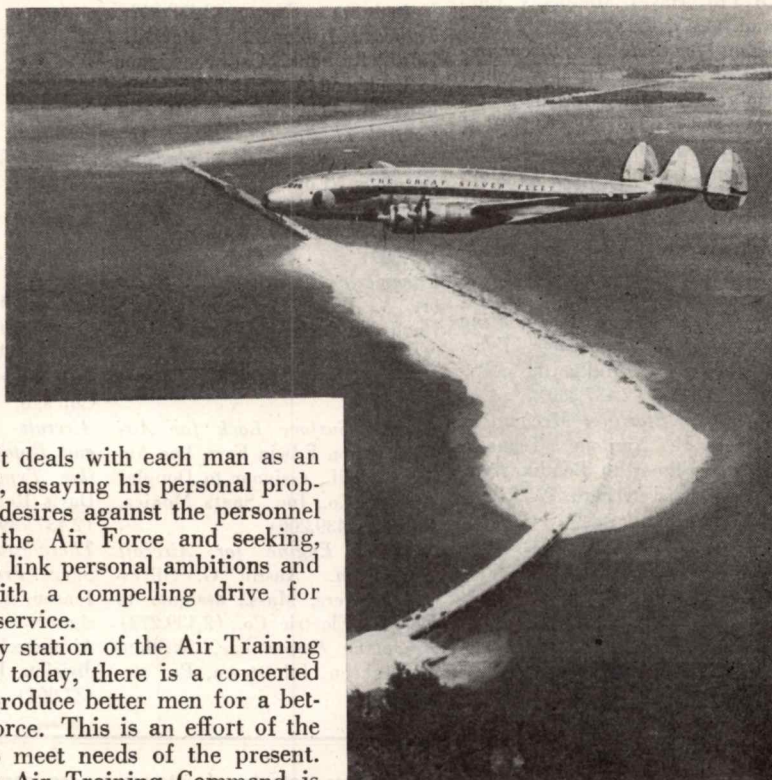
Basic Training

The post-war Air Force basic military-training program, conducted by Indoctrination Division, Air Training Command, Lackland Air Force Base, Texas, is marked by an approach to training more individualized than any previously known in the service. The new program, embracing all the elementary subjects essential to preparing the young American to take his place in the Air Force, recognizes personal motivation as the key to individual

success. It deals with each man as an individual, assaying his personal problems and desires against the personnel needs of the Air Force and seeking, always, to link personal ambitions and desires with a compelling drive for superior service.

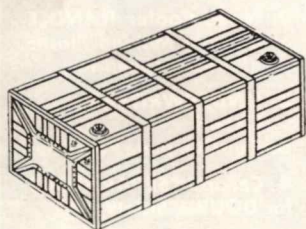
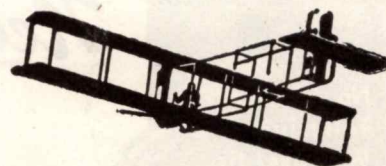
At every station of the Air Training Command today, there is a concerted drive to produce better men for a better Air Force. This is an effort of the present to meet needs of the present.

But the Air Training Command is also looking far ahead. It is more than a training institution. It is an active force that must link, in the most effective manner possible, the manpower of the nation with the air defense of the nation.



Four-mile Rickenbacker Causeway, linking the Florida mainland with Virginia Key, Crandon Park and Biscayne Key, appears directly below a shiny Eastern Air Lines "Constellation." The new causeway was named for Eastern's popular "Capt. Eddie"

AVIATION PATENTS



2,437,058

Collapsible Container for Air Transportation of Fluids. Harry F. Waters, New York, N. Y. (**2,437,058**) (Illustration)

Airplane Landing Gear and Emergency Release Mechanism Therefor. Gordon R. Steinhoff, Santa Monica, Calif., and James W. Blair, Tulsa, Okla., assignors to Boeing Airplane Co., Wichita, Kans. (2,437,135)

Helicopter Lifting Screw Operating Mechanism. Arthur A. Locke, Detroit, Mich. (2,437,165)

Self-Contained Unit for Variable Pitch Propellers. Archibald Graham Forsyth, Cheam, England, assignor to The Fairey Aviation Co. Ltd., Hayes, Middlesex, England. (2,437,189)

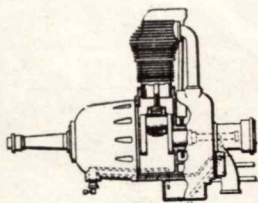
Means for Selective Disconnection of Aileron Controls. Robert Ambrose Flynn, United States Navy. (2,437,250)

Auxiliary Control Mechanism for Automatic Pilot. Pliny G. Holt, United States Navy (2,437,256)

Helicopter Steering Surface Control. Elden L. Kirchoff, Hawthorne, Calif. (2,437,324)

Variable Incidence Wing Control for Aircraft of the Rotary Wing or Airplane Sustained Type. Alexander S. Mullgardt, Altadena, Calif. (2,437,330)

Engine Starting Mechanism. Romeo M. Nardone, Teaneck, N. J., assignor to Bendix Aviation Corp., Teterboro, N. J. (2,437,400)



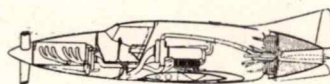
2,437,467

Variable-Speed Drive for Propellers. Earl R. Herring and Charles P. Sander, Glendale, Calif., assignors, by direct and mesne assignments, to Kinner Motors, Inc. (**2,437,467**) (Illustration)

Radio Indicating System. Ross B. Hoffman, Glen Ridge, N. J., assignor to Federal Telephone and Radio Corp., New York, N. Y. (2,436,805)

Protective Apparatus for Preventing Accumulation of Ice on Airfoils. Eugene E. Heston, Akron, Ohio, assignor to the B. F. Goodrich Co., New York, N. Y. (2,436,889)

Towed Aircraft and Means for Towing the Same. Charles Stanley Bell, Oakley, near Aylesbury, England. (2,436,988)



2,439,817

Aircraft Powerplant of Jet Propulsion Type. Pierre Ernest Mercier, Westport, Conn. (**2,439,817**) (Illustration)

Automatic Dimpler. Edwin V. Christensen, Hollywood, Calif., assignor to Lockheed Aircraft Corp., Burbank, Calif. (2,438,842)

Wing Air Slot. Edwin H. Polk, United States Navy. (2,438,942)

Tailless Airplane. Walter H. Korff, Burbank, Calif., assignor to Lockheed Aircraft Corp., Burbank. (2,439,048)

Control of Rotating Wing Aircraft. Charles Francis Hodson, Burnham, England, assignor to The Fairey Aviation Co. Ltd., Hayes, Middlesex, England. (2,439,089)

Pneumatic Aircraft Float. Robert A. Wolf, Eggertsville, and Luell M. Graham, Williamsville, N. Y., assignors to Bell Aircraft Corp., Wheatfield, N. Y. (2,439,196)

Control Surface Lock for Aircraft. Alton Edwin Farr, Los Angeles, Calif., assignor to Douglas Aircraft Co., Inc., Santa Monica, Calif. (2,439,206)

Turbojet Engine for Aircraft Propulsion. Austin G. Silvester, Danvers, Mass., assignor to General Electric Co. (2,439,273)

Aeroplane Empennage. William H. Jackson, Johnstown, Pa. (2,439,304)

Airway Traffic Controlling System. Oscar H. Dicke, Rochester, N. Y., assignor to General Railway Signal Co., Rochester, N. Y. (2,439,846)

Airway Traffic Controlling System. Neil D. Preston and Forest B. Hitchcock, Rochester, N. Y., assignors to General Railway Signal Co., Rochester. (2,439,862)

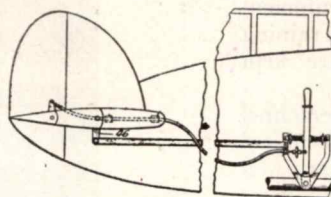
Gunner's Turret for Aircraft. Julius G. Villepigue, Inglewood, Calif., assignor to North American Aviation, Inc., Inglewood, Calif. (2,439,878)

Helicopter and Airplane Sustained Aircraft. Glenn H. Bow-lus, San Marino, Calif. (2,440,003)

Fluid Flow Regulator. James Olcott and Allan C. Hoffman, Dayton, Ohio, assignors to United Aircraft Products, Inc., Dayton, Ohio. (2,440,059)

Deicing System for Aircraft Surfaces. Everett P. Palmatier, Upper Montclair, N. J., assignor to Curtiss-Wright Corp. (2,440,115)

Helicopter Rotor Mounting and Drive. Cyril George Pullin, Wimbledon, London, England. (2,440,225)

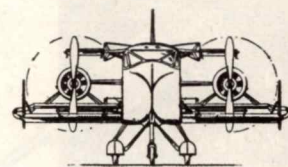


2,439,356

Control Mechanism for Related Control of Operated Mechanisms. Charles A. Arens, Chicago, Ill., assignor to Arens Controls, Inc., Chicago, Ill. (**2,439,356**)

Aircraft Provided with Fixed and Rotary Wings for Convertible Types of Flight. Samuel Davis Robins, New York, N. Y. (2,437,789)

Thermostatic Shutter Control and Surge Protection. Raymond W. Jensen, Los Angeles, Calif., assignor to The Garrett Corp., Aircsearch Manufacturing Co. division, Los Angeles, Calif. (2,437,961)



2,437,684

Aircraft Having High-Lift Wing Channels. Willard R. Custer, Hagerstown, Md. (**2,437,684**) (Illustration)

Booster Type Servomotor System. Clarence L. Johnson, Encino, and Robert R. Richolt, Tujunga, Calif., assignors to Lockheed Aircraft Corp., Burbank, Calif. (2,437,536)

Shock Absorbing Strut for Aircraft. Thomas Knox, Newton, Pa., assignor, by mesne assignments, to Kaiser Fleetwings, Inc. (2,438,011)

Method of Making Manifolds for Engines. Harold Caminez, Williamsport, Pa., assignor to Avco Manufacturing Corp. (2,438,145)

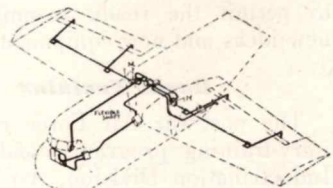
Aircraft Propulsion Mechanism. Ralph B. Davis, Prestonsburg, Ky. (2,438,151)

Gyroscope Erection System. Hugh G. Hamilton, Baldwin, N. Y., assignor to Eastern Air Devices, Inc., Brooklyn, N. Y. (2,438,213)

Wing Lift Control for Aircraft. Edward A. Stalker, Bay City, Mich. (2,438,255)

Control Device for Airplanes. Charles H. Zimmerman, Nichols, Conn., assignor to United Aircraft Corp., East Hartford, Conn. (2,438,309)

Apparatus for Propelling and Increasing the Lift of Airplanes. Clyde B. Ferrel, San Francisco, Calif., assignor to Ferrell Industries, Inc., Reno, Nev. (2,437,732)



2,438,352

Aircraft Control Apparatus. Elbie C. Strong, Long Island City, and Leverett M. Clark, Tuckahoe, N. Y., assignors, by mesne assignments, to Waugh Equipment Co., New York, N. Y. (**2,438,352**) (Illustration)

These patents, of interest to the aeronautical industry, were compiled from recent issues of the *Official Gazette* of the U. S. Patent Office. Copies of the individual patents, in pamphlet form, may be obtained from the Commissioner of Patents, Washington, D. C., at a cost of 25 cents each.

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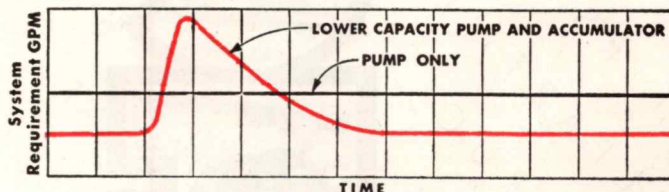
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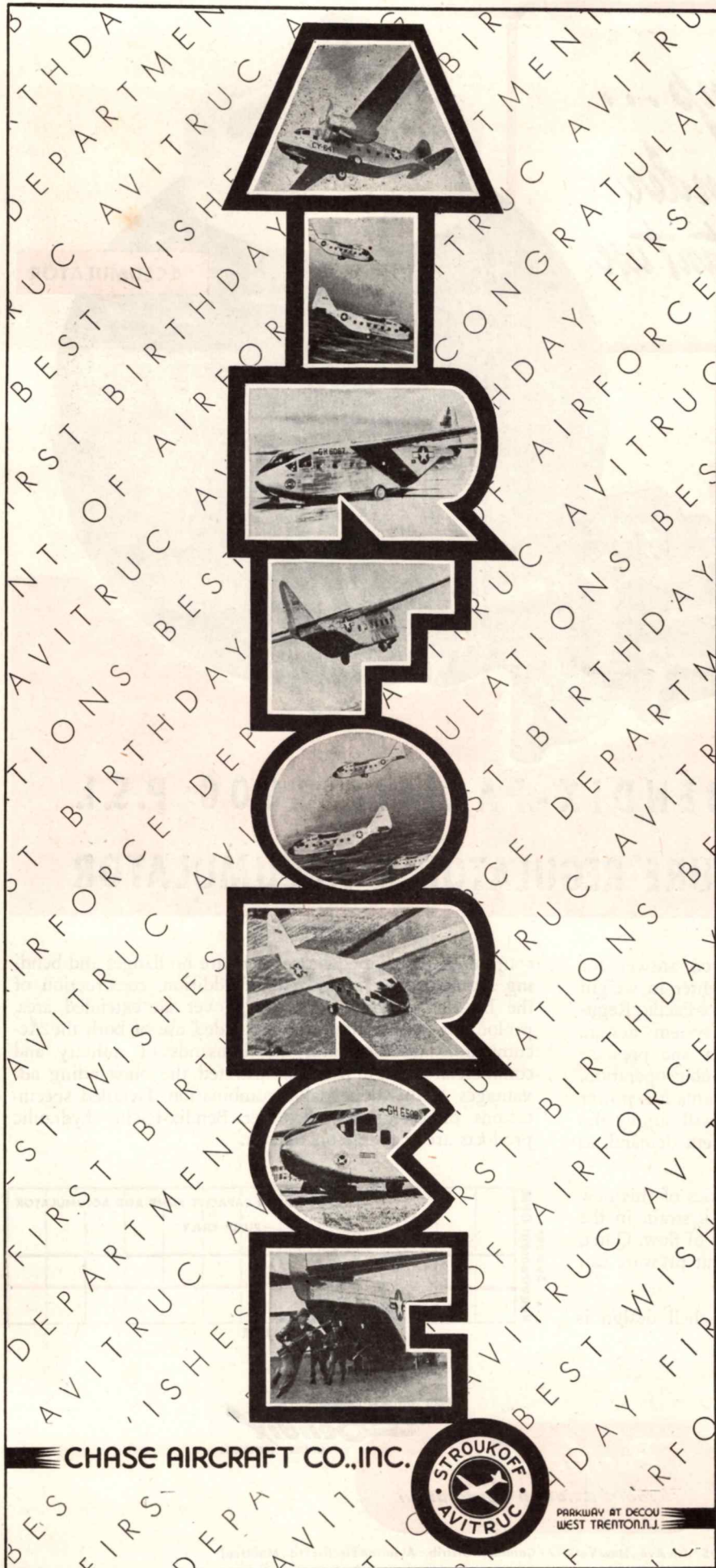
The reliable, smooth operational characteristics of this new improved Regulator materially reduces shock strain in the system. The Regulator will handle high rates of flow. Quiet, positive operation is inherent and the cut-out pressure can be adjusted through a wide range.

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HELICOPTERS

(Continued from page 74)

the aircraft with fuel and make an airplane type take-off. By the time the aircraft reaches the scene of the rescue, sufficient fuel has been consumed to permit hovering flight for accomplishing the rescue. With such an arrangement, the XH-10, for instance, can attain a range in excess of 1,000 miles.

In addition to its rescue role, the XH-16 will provide the Air Force and Navy with a light cargo helicopter featuring a much improved payload capacity and multi-engine reliability. Design trends in cargo helicopters are toward larger aircraft emphasizing liberal center of gravity limits, ease of maintenance, automatic pilots, and the ability to fly blind and navigate accurately over long ranges.

Jets for Crane Types

In the flying-crane class of helicopters, studies to date indicate that jet propulsion should be employed, since the conventional systems appear to have practical limitations in size due to the high torque loads resulting from applying very high powers to large, slow-turning rotors. Since it is necessary to keep the rotor blade-tip speed low for good vertical-lift efficiencies, the rotor of 100-ft diameter should probably be limited to about 100 rpm. This would require gear reductions of approximately 25 to 1, which would ultimately result in an excessively heavy transmission system. By applying jets to the blade tips, this torque reaction problem is eliminated.

New cargo helicopters will have provisions for carrying detachable cargo compartment "packs." It will thereby be possible for airplanes to transport these packs to the nearest forward airport or landing zone, with helicopters then transporting the same compartments to their destination without necessitating the transfer of the contents.

Rotary-wing research in the interest of general over-all improvement of this type of aircraft is being conducted by the Air Force on many projects, e.g.:

Jet rotors and test rigs are utilizing various types of jets including ram, pulse and pressure jets. These tests are being conducted to evolve a helicopter having simplicity and high useful-load characteristics. The principal problems in this direction are the reduction of fuel consumption and increasing the life of the jet burner units.

Two-speed transmissions are being considered for conventionally powered helicopters to increase their vertical lift efficiency and their top speed. The present limitation in helicopter speed is the stalling tendency of the retreating blade. This can be overcome by increasing the rotor speed, which in turn has the effect of decreasing efficiency in vertical flight. The use of two-speed transmissions will allow slow rotor speeds for vertical flight and higher rotor speeds for forward flight.

Various types of metal rotor blades, rotor heads, governors and control systems are constantly under development,



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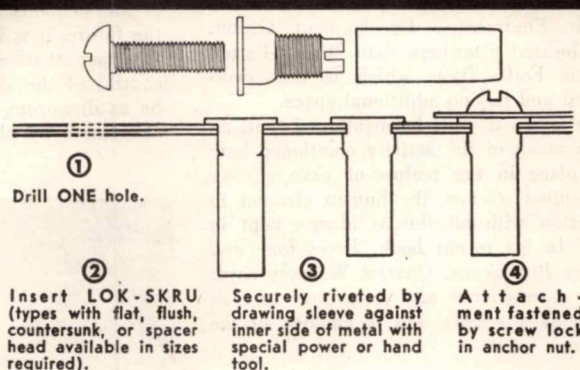
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which will make the helicopter more useful by improving its all-weather characteristics, and its flight and handling characteristics.

Tugboat Duty

Projects are under way to develop towing or fuel-transfer techniques for helicopters in an attempt to increase their range as discussed in the above section on rescue helicopters.

Rotary-wing gliders are being given consideration as observation platforms when towed behind crash boats and other vessels. An aircraft of this type was used by the Germans and operated from the decks of submarines. Present work with rotary-wing gliders is limited to small types, but, if proved feasible, might be increased in size to replace the normal glider.

The possible use of captive helicopters for the supporting of radio antennas, relay stations, et cetera, has not been overlooked.

In order to overcome the speed-and-range limitations of the helicopter, many designers are striving to marry the helicopter and airplane, retaining the best virtues of both. Such an aircraft would prove invaluable in rescue operations and liaison work. Possibly it will some day prove to be the first aircraft to become popular as the aerial "flivver" which can land in any backyard but still cruise at an attractive speed. Sure—we don't want to have to dodge them, but our dads didn't worry about that either when they put the automobile on the road.

In contrast to the uselessness of airplanes upon their retirement, many are the souls who can foresee a venerable old age for helicopters that are no longer airworthy. They make the best danged clotheslines and hay-driers!

So, brother, don't sneer the next time you see an "infuriated palm tree" dusting off the apron. One may be occupying your backyard someday!

RESEARCH

(Continued from page 63)

development of the ejection-type seat necessitated considerable research to determine the ability of the human body to withstand the tremendous accelerative forces that would be exerted, particularly upon the spine.

Although the jet fighters now in use and in production represent years of planning and testing, the Air Force regards them as merely the beginning of jet-fighter production. New aircraft are being considered whose performance in penetration, interception, and all-weather flying will be far superior to that of current types. The test flights of the X-1 have shown that travel at supersonic speeds may eventually be accomplished in combat types.

Continued experimentation is being carried on with other types of aircraft such as reconnaissance aircraft, helicopters, various kinds of trainers, liaison and cargo planes as well as gliders.

One of the principal concentrations of re-

search and development is the guided-missiles program, which was begun during World War II. At that time the Germans had made considerable advancement along these lines, with the V-1 and the V-2, but these had been developed too late to stop or even seriously to slow up the Allied victory. The American effort in the closing phases of the war was to adapt the guided-missiles techniques to conventional types of equipment, particularly in the case of glide bombs and torpedoes and controllable high-angle bombs; but most of the emphasis was kept on conventional weapons.

Guided Missiles

The guided-missiles program has been intensified since the war. Attention at present is focused on four types: air-to-air, surface-to-air, air-to-surface and surface-to-surface guided missiles. Air-to-air missiles are for offensive use against enemy forces and for protection of our own bomber formations. Surface-to-air missiles will not only attack invading aircraft but in time will also be used against enemy missiles. Air-to-surface types are being designed to increase the effectiveness of our bombers by demolishing enemy targets while the aircraft launching them remain outside heavily defended areas. Surface-to-surface missiles are intended for both long-range and short-range use, for both strategic and tactical missions.

Research and development hopes to produce a long-range supersonic missile of considerable effectiveness. It must be remembered, however, that it takes years of experimentation to bring a single weapon of

this kind into operational usability. The biggest problem in relation to missiles is not the propulsion system, and not the aerodynamics of missiles themselves, but the incorporation of the brain to guide and control the missile to the target.

Research and Development is intensifying its work with electronics, particularly with all types of radar, and is also keeping up its extensive meteorological studies. In order to carry on all these other proposed activities, the Air Force needs considerably larger facilities than it now possesses; consequently the Air Force plans to construct an Air Engineering Development Center, to be located elsewhere than Wright-Patterson Air Force Base, which is now overcrowded and has no additional space.

Once again it must be mentioned that, although much of the activity mentioned here takes place in the realms of pure science and applied science, the human element in connection with all this is always kept in mind. In his recent book, *Psychology and Military Proficiency*, Charles W. Bray says: "There is a science and technology of man as well as a science and technology of the machine."

STRATEGIC THINKING

(Continued from page 58)

The report of the Civilian Chairman of the President's Strategic Bombing Survey, Pacific War, also stated in part:

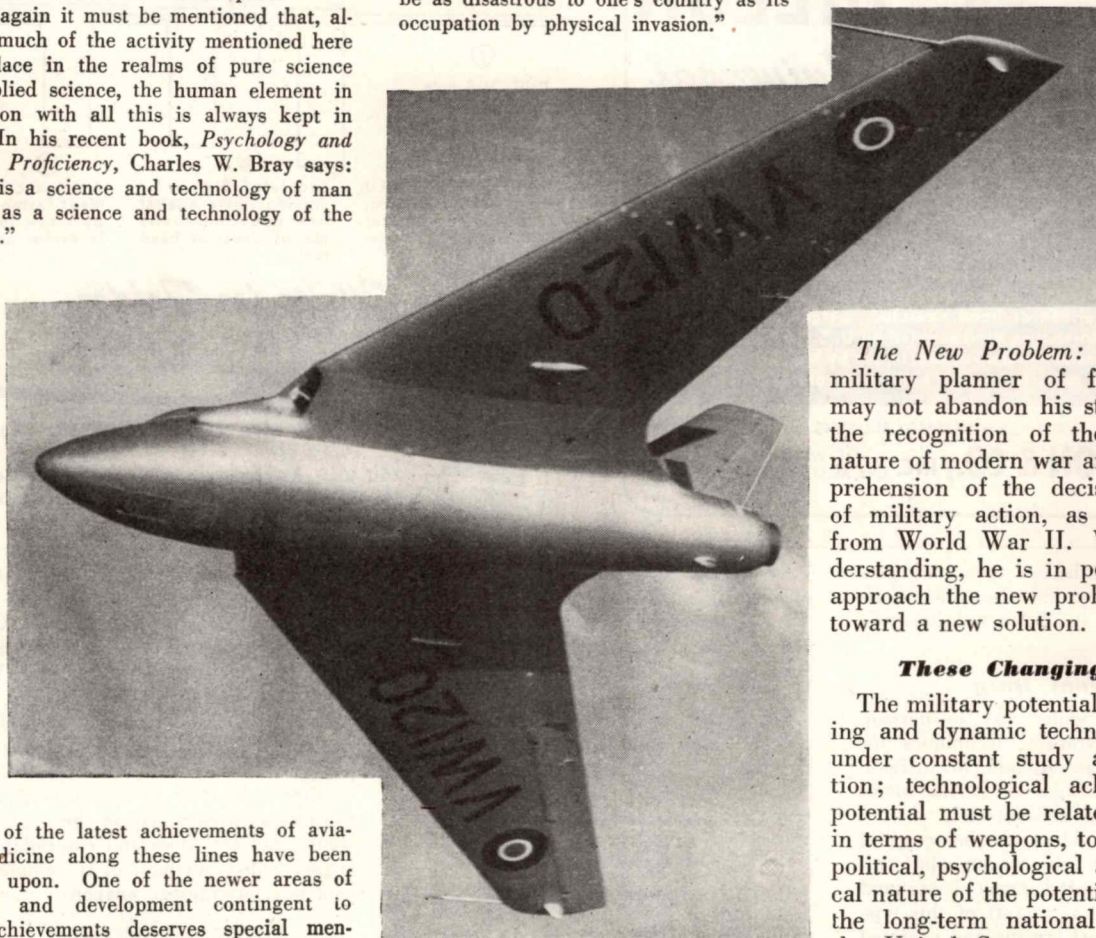
Page 28: "... It further supports the findings in Germany that no nation can long survive the free exploitation of air weapons over its homeland. For the future, it is important fully to grasp the fact that enemy planes enjoying control of the sky over one's head can be as disastrous to one's country as its occupation by physical invasion."

the Japanese people from extermination."

Page 27, under "Signposts": "1. Control of the air was essential to the success of every major military operation. . . ."

And, on the 21st of April 1948, Secretary of Defense Forrestal testified as follows before the Senate Armed Service Committee:

"... All three services—Army, Navy, and Air Force—agree that Air Power is likely to be the decisive element in our national strength. . . ."



Some of the latest achievements of aviation medicine along these lines have been touched upon. One of the newer areas of research and development contingent to these achievements deserves special mention: engineering psychology.

This concerns the adaptation of the airman to new-style equipment, particularly in relation to the design of instrument displays and controls, in the creation of complex man-and-machine systems and in the recognition of human limitations in connection with the use of newly developed equipment.

The studies in this category have been in progress for only a few years; yet professional psychologists have already recognized them as comprising a new branch of the subject, an extremely significant one in this age of accelerated technical developments. This is another demonstration of the fact that every mechanical advance, however slight, is matched by a corresponding development in our knowledge of the human factors which are so important in the operation of aircraft and the use of equipment. The Research and Development approach to these problems is an integrated approach.

The New Problem: However, the military planner of future strategy may not abandon his study with only the recognition of the fundamental nature of modern war and with a comprehension of the decisive categories of military action, as they emerged from World War II. With such understanding, he is in position only to approach the new problem—to work toward a new solution.

These Changing Times

The military potential of a fast moving and dynamic technology must be under constant study and interpretation; technological achievement and potential must be related, objectively, in terms of weapons, to the economic, political, psychological and geographical nature of the potential enemy; and the long-term national objectives of the United States must provide the cornerstone from which military strategy will be derived.

If we grasp these few fundamentals and apply them with logic and realism, our military plans for the continued security of this nation should be on a solid foundation.

We will have made dispassionate and analytical evaluations of past battle experience in terms of cause and effect and with a clear comprehension of the nature of modern war. Our evaluations will have recognized the phase of war involved—build-up, decisive or exploitation. It will have provided a sound and realistic basis, rather than a service-slanted position, for forward thinking.

Our understanding of the impact of

The Goblin-powered D.H.108 was designed to explore the problems of control in aircraft with sweptback wings. When warplanes embodying these principles become operational air warfare and its related strategy will be forced to take on a new tempo

Page 26: "... Nevertheless, it seems clear that, even without the atomic bombing attacks, air supremacy over Japan could have exerted sufficient pressure to bring about unconditional surrender and obviate the need for invasion."

Page 21: "... General Takashima, when asked by the Survey as to his reaction to the Imperial Rescript, stated that surrender had become unavoidable; the Army, even should it repel invasion, could no longer protect

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technology on warfare and our appreciation of the power of modern air weapons, coupled with the knowledge of the fundamental military and economic nature of our potential enemy, will have pointed the way to an objective strategy.

Our projected thinking will have visualized clearly the essential category of decisive action—a decisive action in consonance with technological development and appropriate to the achievement of our national objectives at the least cost to ourselves and to civilization.

F-80'S ACROSS

(Continued from page 35)

fly as far as Iceland, holding up there until the British landed at Goose Bay, in order to take advantage of good weather.

But it was no go—Schilling was ordered to wait. In fact, word went around that the Strategic Air Command had not only refused him permission to take off, but had also wired the commander of the Goose Bay base to make certain that Schilling did not leave. There was never any confirmation of this—just a story that made the rounds.

That's how it was at Goose Bay. The six British jets landed in beautiful formation on the night of July 14. They had been preceded shortly before by a photo reconnaissance version of the *Mosquito*, which had flown an hour ahead of the main flight on the over-water crossings to scout the weather. Each flight of three *Vampires* was led by an additional PR *Mosquito* Mk 34. Average indicated air speed was 220 mph at 30,000 ft, an equivalent ground speed of about 380 mph. The USAF boys had dinner with the RAF pilots, who gave them rather bad news as to their experience with the weather.

Anyway, by Thursday afternoon, the next day, the Americans were set to go. A B-29 weather plane, specially assigned to the flight, had taken off hours earlier to report on conditions.

The 16 jets were all gassed up. A B-17 air-sea rescue plane, an F-13 (B-29 photo ship), a C-47 and two C-54's were ready to move out as the task force of the *Shooting Stars*, a force assembled at Selfridge and MacDill Air Force Bases.

The departure from Goose Bay was set for 4 p.m. As a sending-off treat, the British fliers put on an astonishingly fine show over the air base, and while Schilling and his men watched the RAF go through its paces, the bad news broke.

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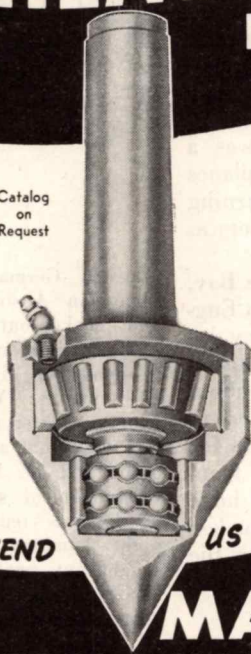
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Came the message from the B-29 weather ship: "Weather over BW 1 marginal. Relax and unpack."

So it wasn't until Saturday morning, July 17, that the flight finally went on to Greenland. The jets came through the treacherous Tuna Fjord with everything to their advantage. The weather was perfect, and one by one the *Shooting Stars* whooshed in to a landing.

Goose Bay to BW 1, a distance of 776 miles, was flown in 1 hour and 50 minutes.

A 24-hour delay was caused by bad weather over the approaches to Meeks Airport at Keflavik, Iceland, and so the leg there had to be flown on the following day. 747 miles in 1 hour and 45 minutes.

Again bad weather, this time on the final spurt of the ocean hop, from Iceland to Stornoway. Strong head winds, along the 670 miles, and a low ceiling over the air base. Another day's delay. Thus, on July 20, Col. Schilling and his weather-weary fliers landed at Stornoway—eight days after leaving Michigan.

On July 21, the 16 jets took off for the RAF base at Odiham, 40 miles west of London, and landed that afternoon to be welcomed by top British air officials. The flight from Stornoway, 670 miles, was done in 1 hour and 40

minutes.

Schilling's men buzzed the picturesque all-jet base for a few minutes, then one by one landed. Carrying wing drop tanks for extra fuel, the Americans couldn't stunt very well. But as the flights of four jets each came over Odiham, they criss-crossed the field at high speeds, zoomed away, then dropped.

On Sunday, July 25, the jets and their task force arrived at Furstenfeldbruck, near Munich, for two weeks of combat training maneuvers and emergency alert duty, the latter brought on by the Berlin crisis. The 660 miles were covered in 1 hour and 42 minutes.

All told, the jets had flown a distance of some 5,000 miles in 12 hours and 30 minutes. The over-ocean flight of 2,193 miles was done in 5 hours and 15 minutes. The average speed from Selfridge to Furstenfeldbruck was about 430 miles an hour. The average altitude was between 33,000 and 35,000 feet.

Fuel Consumption

Fuel consumption, the most important aspect of the whole flight, "was encouraging," so Col. Schilling reported, but the exact figures on this were restricted. However, each jet carried about 800 gallons of "J-P 1" and

all had an average of about 110 gallons in their tanks at the end of a flight.

That is how it all went. The flight itself, as far as the mission was concerned, went off well. But this flight is being looked upon as a possible precedent, and as such, falls in the realm of disappointment.

Disappointment because of the weather—and only the weather. It is something that can't be bucked.

Possibly it is significant that the jet planes which are being assigned permanently to Germany were shipped to England and Scotland via freighter and aircraft carrier, for subsequent ferry flight to the United States zone.

True, 80 of these 95 F-80's came from Panama, and a much longer flight would be involved. Nevertheless, there appears to be a certain strategy in the shipment of planes by water. It is a sure way of getting fighter aircraft to Europe without depending on the weather, a feeling expressed by one observer who said: "The Navy will sure get a kick out of this!"

Whatever the outcome, let it be said that the 16 Air Force fliers represented the apex of ability. Their average age is 25, most of them are married. They were no hell raisers when socked in by weather. They read, listened to the radio, sat around with understandable

impatience. They wanted to "go" all the time.

They flew their planes well and are representative of the men who make up American airpower today, although it may be that these boys have just a bit of added cockiness.

The jet flight came against a background of international developments that served to underscore the mission. The great food lift was on, and despite a statement by the State Department that no diplomatic importance was attached to the jet flight, there was a general feeling that the 16 jet planes were to be in Germany as a warning to the Russians, lacking in numbers as we were.

While the jets waited at Goose Bay, the 60 *Superfortresses* assigned to England came through. Great secrecy involved the flight, and an unusual amount of security was placed about the big bombers. Crews were fed in units at the consolidated mess, and for the most part, were kept away from the regular base personnel. The huge *Superforts* stayed at Goose Bay for less than 12 hours, then headed for the bases in England.

Over-Optimism

Tied in with this, plus the movement by the jets, came the report from a United Press correspondent that up to 400 B-29's eventually were to be based in England. The report was based on the correspondent's observations at Goose Bay, Iceland and in England—observations which included the lengthening of runways, the installation of additional fuel pumps and more barracks for enlisted personnel.

Thus, when the jets landed at Odiham there was the general feeling that American airpower in Europe, presently reduced to where it could not fight its way out of a paper bag, was in the process of being built up all over again.

The presence of the jets in Germany for the two-week period beginning July 25 added something to our fighter strength there, at least temporarily. (*The F-80's left Germany on August 14th, arriving at Selfridge on the 21st.—Ed.*) They were based at Furstenfeldbruck, our heavy bomber station in Germany, while the operational fighters, 75 of them or so, were at Neubiberg, close by.

At Wiesbaden, headquarters of USAFE, Air Force officials revealed other weaknesses in American airpower in Germany, and at the same time, contrasted it with what the Russians were known to have.

For example, they said, while our heavy bomber strength numbered the 30 B-29's then based at Furstenfeldbruck, the Russians were disclosed to

have between 200 and 300 heavy bombers. Against our 75 fighters based at Neubiberg, the Russians were revealed to have a force of between 700 and 800 first-line aircraft.

In addition, the air force in Germany was said to be suffering from a lack of trained personnel. Whatever we had, the situation, as one colonel put it, "couldn't be any worse."

Nevertheless, a program to build up our bases in Germany now is under-

way. Runways are being extended at Furstenfeldbruck, Neubiberg and Wiesbaden. The supply depot at Erding also is being built up. New facilities, such as barracks and hangars, are being added to accommodate more men and planes.

Having hit rock bottom, there is only one way in which our air force, once the most powerful in the world, can go. That is back again to strength in numbers.

THE U. S. AIR FORCE, 1909-1948

(Continued from page 71)

attacked German plane and ball-bearing plants in Austria, Bavaria and Hungary, and knocked out the oil refineries at Ploesti.

When the war in Europe was over, the testimony of high German officials boiled down to this: "We failed primarily because your air power robbed our skies of protective wings, our armies of mobility, our tanks of oil and our factories of raw materials." Production of steel in the Ruhr, for example, was reduced by 80%—largely by night bombing. American day bombers sought out smaller precision targets, with smashing attacks on the German aircraft centers and principal refineries and synthetic oil plants—so that production of aviation gasoline dropped from 175,000 tons per month to 5,000 tons—a mere trickle.

Allied air power was decisive in the War in Western Europe, although the full striking power of the AAF was not attained until the winter of 1943-44. Invasion by land still was deemed necessary—it was not to end as purely an air war. But one fact became self-evident: the nation that gains control of the air must win, while the nation that loses control of the air eventually must lose.

Even during and after the invasion, air power was the spearhead. General Eisenhower said that our strategic bombing campaign had cut down German air opposition to a minimum. As our ground forces advanced, our tactical air power smashed enemy tanks, armored trucks and supplies. Both our heavy bombers and bomb-carrying fighter-bombers were especially good at knocking out communication facilities—not a bridge spanned the Rhine! Rail networks were paralyzed for weeks at a time.

At the moment, American occupation forces are cut off in Berlin; if war comes, it is only a question of time when Russian forces not only in Berlin but in all Europe will be cut off from Russia. History will repeat itself. That is one prophecy for the book.

In the Pacific campaign, both the Japanese and ourselves underestimated air power—we before Pearl Harbor and the Japs thereafter. If the Japs had really believed in air power, they would have followed their air attack by the invasion and capture of Hawaii. But Jap air power always had been a poor relation of the Jap Navy and Army—which were like the U. S. Navy and Army in their thinking.

We almost lost our shirt as it was, and, for a year and a half, we were on the de-

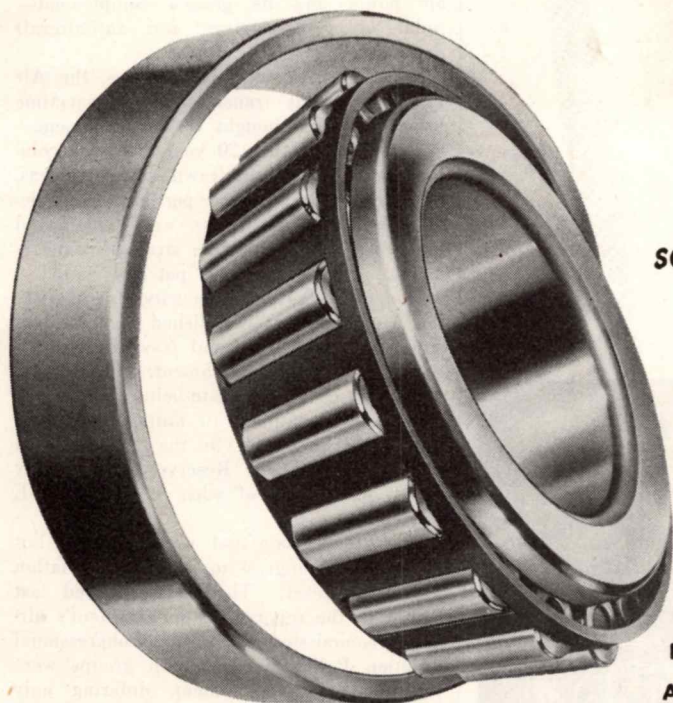
fensive. The Battle of Midway, when a major Jap task force was intercepted and three of its four carriers were sunk, was the turning point, according to Japanese testimony. Ninety-eight Navy and Marine Corps fighters, dive bombers, torpedo bombers and patrol bombers based on Midway with four Air Force B-26's and 17 B-17's were alerted for the attack. The *Flying Fortresses* first sighted the enemy and nine B-17's attacked five Jap ships. The Seventh Air Force did reconnaissance and flew 16 attack missions in the Battle of Midway. But the major air effort was carried out by the heroic pilots of the carriers *Yorktown*, *Enterprise* and *Hornet*. It was the first major air victory in the Pacific, a perfectly integrated joint effort of the Air Navy and the AAF—which could get together better in the Pacific than they ever could afterward in Washington! (There's more old-fashioned Army and Navy brass in Washington than there was in the Pacific.)

The nip-and-tuck victories of Guadalcanal and Papua (New Guinea) saw the beginning of the 12,500-mile-long advance to victory—an advance made possible only by the splendid cooperation of the air-sea-land team, including the Army Engineers and Seabees for hacking out the airstrips for our constantly advancing flying carpet. The surface advance reads like the romantic adventuring of the old navigators of centuries ago, sailing from island to island. The Solomons, the Gilberts, the Marshalls, the Carolines, the Philippines, the Marianas (Saipan, Tinian, Guam), Iwo Jima and finally Okinawa. But land-based and carrier-based air power was the spearhead all the way. And at the end, as General Doolittle remarked, our Army was ready to invade Japan, the Navy was ready to convey it there—and the Marianas-based B-29's made the invasion unnecessary. With an Army still largely intact, and possessed of all its equipment, Japan unconditionally surrendered.

The air war over Europe, Asia, Africa, the Aleutians, the Pacific and Atlantic Oceans cost 37 billion dollars, 23,000 lost planes and 122,819 airmen wounded, missing or dead. In four years of war, 148,943 planes were delivered by American industry; more than 2,360,000 combat sorties were flown against Germany, its satellite nations and Japan, during which 2,000,000 tons of bombs were dropped and 40,000 enemy planes were destroyed. But it had not been only an air war. Alone and unassisted by

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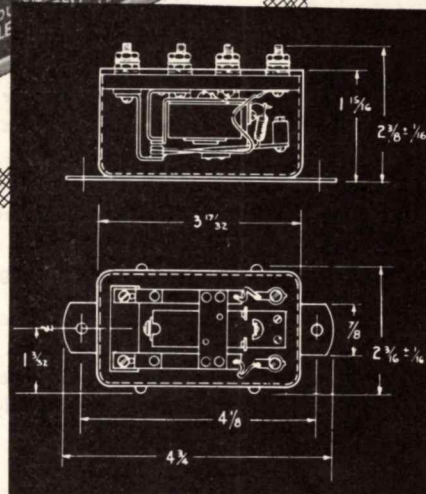
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ground and sea forces, it is improbable that air forces could win the next war, any more than it won the last one.

However, it seems certain that in the next war, as in the last, air power will be the dominant factor. Whether by piloted aircraft in the beginning or guided missiles toward the end of hostilities, the knockout punch must be delivered through the air. In a war between Russia and the U. S., the air is the only highway common to both nations. The only obstructions along that highway will be those set up by opposing air power and its ground complement—radar observation rings and anti-aircraft defenses.

Following the end of hostilities, the Air Force made the transition to a peacetime basis that was thought to be permanent—at least for another 20 years. Major combat forces were withdrawn from overseas, the greater part of the personnel was demobilized and the forces were redeployed in accord with peacetime strategic requirements. The Russians sat pat and waited.

Under the National Security Act of 1947 the Air Force was established in a role co-equal with the Army and Navy in the National Military Establishment. Plans were made for an Air Force-in-being, backed by trained and equipped air units, and a pool of trained personnel in the Air National Guard and the Air Reserve. It is today about one-seventh of what it was on V-E Day, 1945.

Wars may come and wars may go, but the urge of Congress to investigate aviation goes on forever. This urge resulted last winter in the reports of the President's air-policy commission and of the Congressional Aviation Policy Board. Both groups were substantially in agreement, differing only in estimates of air strength required. Let us glance at excerpts from the Presidential commission report:

"We believe that it is the overwhelming view of those most qualified to know that the country must have a new strategic concept for its defense, and that the core of this concept is air power. . . . Of course an adequate Navy and Ground Force must be maintained. *But it is the Air Force and naval aviation on which we must mainly rely.* Our military security *must be based on air power.*" (The shade of Billy Mitchell, the old Army-Navy Haunt, who sent shivers up and down the backbones of generals and admirals, must have smiled sardonically!)

"We have concluded that the minimum force necessary at the present time is an Air Force composed of 12,400 modern planes. . . . And an adequate reserve, now estimated at 8100 aircraft must be created and maintained in a proper state of mobilization." (Seven months later, the Air Force Reserves still are flying only training planes!)

"The new strategy of the Navy is air power. The carrier has become the major ship. . . . The Navy requires 5793 front-line planes, plus about 5100 in support." (The Home Defense Force of the Air Navy at present has only typewriters to use against the Air Force. It declares that it needs four-engined

bombers to operate from giant carriers to attack Russia—and scare hell out of the Air Force!)

The Congressional report said:

Supreme air power, its military and civil arms undivisible, must be the weapon with which the United States protects its freedom. . . . It is the judgment of the Congressional Aviation Policy Board that the capability of the United States most likely to discourage an aggressor against attack, most effective in thwarting it if launched, and most able to deal out retaliation to paralyze further attack is air power."

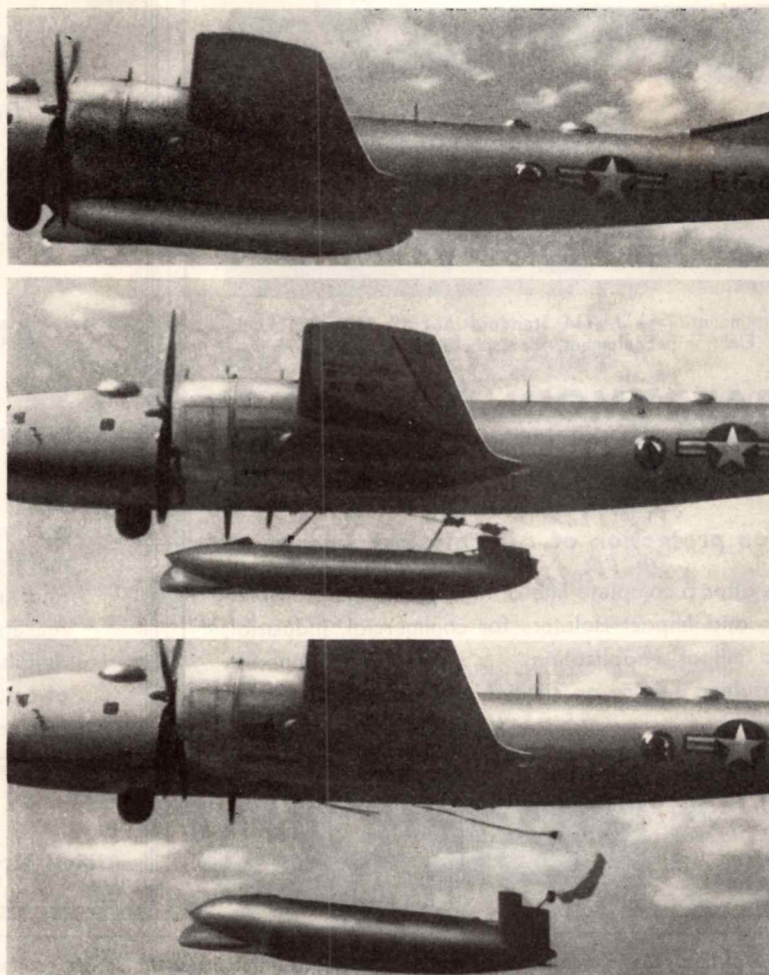
Ever since the end of World War II, Soviet Russia has been on the political move, drawing more and more nations behind the iron curtain. The blockade of Berlin is a squeeze-play to test our strength. On land, Russia is strong in Europe; we and the British are weak. The Russians know the score. The Russians are not afraid of armies. They have defeated in turn the armies of Sweden, of Napoleon's Empire and of Nazi Germany. Undoubtedly they believe—and with reason—that they could hurl back and vanquish any allied American-British Army that we would transport to and supply on the soil of Europe—even mechanized armies supported by tactical air forces, to which the answer is opposing tactical air forces plus artillery, in which the Russians excel.

Russian Water Interests

The Russians are not concerned over navies, except possibly the air element; and they have the submarine to exert its toll of our convoys. They know the score in the Battle of the Atlantic, and probably believe that Hitler would have won that supply battle had he devoted all his naval power to submarines, instead of building old-fashioned battleships that only went out to be sunk by bombs and torpedoes dropped by aircraft of the RAF. The Russians certainly won't make that mistake—but maybe they hope we will follow the tactics of Napoleon and Hitler and try to slog through the mud to Moscow, thus giving Napoleon and Hitler the only good laugh they've enjoyed since they left here.

Already we are showing the Russians that we have the intelligence and the guts to use our air power in the declared political and still undeclared fighting war. We are using only the unarmed planes of the Transport Command to break the siege of Berlin and to feed 2,000,000 Germans trapped there to starve by the Russians. But back of those peaceful air carriers we already have sent a war force to the soil of Britain and Germany—B-29s and jet fighters.

More will follow, if needed. And if tens of thousands more are needed, American industry will provide them; and they will be flown across, while the U. S. Air Navy will see to it—as it did in the Pacific and in the Atlantic—that the heavy supplies for the Air Force will flow in an uninterrupted stream of shipping across the sea. As to the Soviet underseas navy, our Air Navy will deal with that, not only in the open reaches of the ocean but in the harbors from which it must operate—possibly with the



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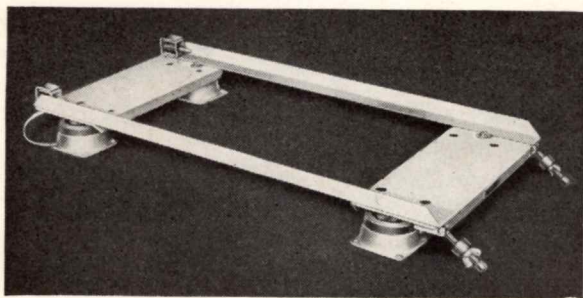
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By CARL A. NORMAN and R. H. ZIMMERMAN

This is an elementary but thorough and expert treatment of gas turbines for aircraft, marine, locomotive, and stationary plants, and jet propulsion apparatus, including rockets. Both performance and design of details are covered. Sample computations of actual design problems are given. There are nearly two hundred figures, performance graphs and photographs.

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assistance of heavy Air Force bombers based in the British Isles.

Back in 1909, when the embryo of the U. S. Air Force was a Wright Model A that flew 42 miles an hour, Brigadier General James Allen of the U. S. Army Signal Corps observed, "The advent of aerial navigation has extended the vulnerable area of a country to every inch of its territory." The history of war in the skies over Germany and Japan has proved this, beyond any doubt.

In two world wars, we have learned that the sure way to invite war is to be weak in military power—which now means air power; that the road to war lies along the paths of conciliation and appeasement of an aggressor. The Russians must learn that we are not aggressors, but that we will suffer no further aggressions; that a war can be won by air power, and that we, who invented the airplane and with the British developed it into the most powerful weapon of all time, will not be intimidated by the most truculent nation that ever befouled the surface of the earth.

AIR COMMUNICATIONS

(Continued from page 39)

possible command level for the particular situation concerned. In short, the Systems Concept presents a single, integrated communication system as the best solution to a problem involving the establishment and management of an airwayscommunications system.

This does not mean that other commands or customers have no voice in the operation of or types of facilities provided. On the contrary, AACS facilities are under the operation control of the commander of the base at which they are located. Operation control is defined as the determination of the locations and types of facilities required by the command concerned, the nature of the services to be rendered to it, and the sufficiency and efficiency of facilities and services to meet its operating requirements. AACS must insure that adequate facilities are provided and operated in such a manner as to serve the requirements of all elements of the Air Force.

Telephone Analogy

In order to explain more clearly the Systems Concept as it finds expression in AACS, I wish to point out an analogy to be found in a big business organization. Now there are literally hundreds of local telephone companies in the U. S.—more than 900 actually—which serve communities of various sizes. But, there is only one American T&T system to handle long-distance calls. You can imagine how much long-distance service you would get if you depended for it on coordination between several hundred local companies. I doubt if you could ever get agreements as to which company would construct the wire lines between the companies, let alone solve the problems of operation.

Fortunately for the U. S., the American T&T takes care of all that by building inter-connecting lines and working out rate schedules, routing instructions, operating

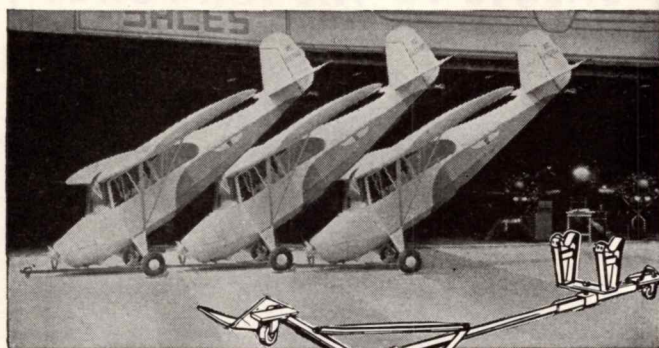
procedures and a number of other details which are necessary to enable any local telephone subscriber to call any other phone in the U. S. and even in many overseas locations. In other words, the A T&T is a working example of the systems concept as applied to the telephone business. Now, with this analogy in mind, let us examine our version of this concept.

4. *Why AACS was organized*—Prior to and during the initial phases of World War II, an adequate system of airways communications capable of supporting military operations under all-weather conditions was not available. This deficiency was recognized by General Arnold as early as 1934 as a result of leading a flight of B-10 aircraft from the U. S. to Alaska and return, together with subsequent maneuver involving a flight of B-10's from March Field, Calif., to Langley Field, Va., in connection with participation in a simulated attack on Ft. Dix, New Jersey.

In those days airways communications consisted of a series of radio ranges and light beacons operated by the CAA. Communication between the ground and aircraft was restricted for the most part to short-range voice contacts with the radio-range stations. An airway system outside the U. S. was practically non-existent. Messages from Base to Base were sent via Western Union.

The increased mobility of the B-10 aircraft had a marked effect on military strategy and gave foreseeing people the first idea of the major role to be played by the Air Force in future wars. Needless to say, communications support was recognized as being essential to the eventual success of air power.

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However, communications for military aircraft had become a problem of such proportions by November 1938 that it was necessary to organize an airways-communications system distinct from the purely ground-administrative facilities of the Signal Corps and the civil air-route facilities operated by CAA.

5. *History*—Therefore, a new organization was formed and it was called the Army Airways Communications System—short title AACS—recently renamed the Airways and Air Communications Service. At its inception, AACS assumed responsibility for establishing 33 stations consisting of a combination of control towers, ground-air, point-to-point and radio-range facilities in the United States. A total of three officers and 300 enlisted men was authorized.

From these small beginnings, AACS was expanded by VJ-day into a worldwide system totalling 786 stations comprised of 5435 various types of facilities, i.e., radioteletype, facsimile, GCA, ranges, Loran, radar, etc., manned by 4500 officers and 45,500 enlisted personnel and operating worldwide.

It is worthy of mention at this point that, prior to 1941 and due to various reasons (mainly budgetary limitations), airways-communications facilities consisted mostly of manual radio-telegraph, control towers, low-frequency radio ranges, etc., suitable only to support small flights of short ranges, slow speed and fair-weather nature. To keep pace with the development and mass production of highly versatile aircraft and to support mass flights under all-weather conditions throughout the world, it was necessary to develop, procure and install im-

proved types of facilities.

Some of these developments include automatic radioteletype for handling large volumes of weather and operational data; blind-landing facilities, i.e., GCA and SCS 51, to permit safe landing of aircraft under closed weather conditions; Loran, to permit accurate navigation over wide areas where it was not feasible or possible to install a series of radio ranges; Very High Frequency-communication sets, to permit reliable static-free voice communication with all types of aircraft—but primarily for fighter-type which, due to space limitations, could not be equipped with suitable high-low frequency equipment; and VHF and HF direction-finding sets suitable for aeronautical service to assist lost aircraft in reaching their destination and to aid in air rescue operations.

As Recently As 1941

It is pertinent to point out that, excepting a few facilities in the US and possessions, there were no airways facilities available in 1941 to support overseas routes. Therefore, it was necessary to procure, ship and install facilities in all parts of the world to provide these air routes.

Stations were installed in Newfoundland, the icecaps and bleak wastes of Labrador, Greenland and Iceland to set up the North Atlantic air route to England over which were ferried aircraft, personnel and supplies necessary for the defense of the British Isles and subsequently the destruction of Germany.

Concurrently, stations were being installed throughout the Caribbean, South America

and through the heart of Africa to make possible the supply of men and material to combat the submarine menace in the Atlantic and Caribbean and to insure the defeat of Rommel's panzer units in Africa and the Middle East. These routes were later extended to and throughout the China-India-Burma theater.

Of all the theaters in which AACS saw service, none afforded an area of such fantastic contrasts as the CBI theater, which stretched from Sind Desert, east over the Assam Valley, the Bengal and Burmese jungles, the Himalayas and the vastness of China. It was a nightmare of uncharted areas where communications—not to mention modern living—had never existed before.

In the early days, the primary mission of AACS was to provide airways facilities for the Air Transport Command in accomplishing its mission of flying vital supplies over "the Hump" to keep China in the war against Japan. Later, this service supplied communications to the 20th Bomber Command and 10th Air Force in carrying out raids to Japan and operations throughout China and Burma.

Stations were installed throughout the icebound and sub-zero regions of Canada and Alaska and also along the fogbound bleak chain of the Aleutian Islands to form air routes supporting the war against Japan and to expedite the ferrying of aircraft to Russia.

Expansion of air routes in the Pacific were delayed in accordance with the grand strategy of defeating Germany first. Consequently, in the early stages of the war,

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AACS activities were confined to supplying airways service between the U. S., Hawaii and Australia. However, as the "island-hopping" offensive began, AACS facilities were installed on malarial and Jap-infested islands to form a series of air routes from Australia through New Guinea north to Manila and from Hawaii west through the central Pacific to Guam and Manila. Facilities were later installed at Okinawa and Iwo Jima to support combat air operations against Japan.

A majority of AACS installations in the Pacific were made under actual combat conditions. For example, at Iwo Jima, Leyte, Guadalcanal and many other locations, the facilities were installed and operated within range of enemy gunfire and while fighting was in progress. The climax of AACS-Pacific operations was reached when AACS airborne facilities landed at Atsugi, Tokyo, and were placed in operation one hour before the occupational forces arrived in order to guide the first American planes to safe landing in Japan.

6. *VJ-Day*—AACS responsibilities did not lessen with the cessation of hostilities on VE and VJ-Days. The existing worldwide system of air routes had to be maintained to support the return home of combat troops and equipment, while, on the other hand, additional facilities had to be installed and operated in Europe and Japan to support occupational forces. These facilities also served the national interest by assisting U. S. airlines in developing their post-war foreign routes.

Needless to say, the fever of demobiliza-

tion presented many problems in maintaining this vital system. In this connection, AACS—pioneer of a worldwide system of airways communications—was the only agency capable of and possessing necessary resources (even though limited) to continue operation of the system.

At the peak of activity—July 1945—the 786 AACS stations located all over the world supported air operations over more than 100,000 miles of air routes. Over the point-to-point networks, which represent only one of the 14 types of facilities operated, approximately 12,000,000 words of weather and operational data were handled daily. As a comparison, this is more than 15 times as many words as are contained in the King James version of the Holy Bible ("773,697 words," advises the Library of Congress). A good portion of this data was classified, therefore it had to be encoded and decoded in a secure cryptographic system prior to transmission and delivery.

Peacetime Aims

7. *Interim period*—During peacetime, the major role of combat organizations is to train for combat efficiency. On the other hand, a service organization such as AACS never assumes a purely training status, but has to meet continuous operational commitments involving safety of life and property. These commitments call for continuous operation 24 hours a day, seven days a week. Additionally, a service such as AACS must have an organizational structure and potentialities capable of rapid expansion to cope with emergency conditions. While

organization is a prime essential, it, alone, is not adequate to do the job. Personnel and equipment requirements must continually be met, if the mission is not to suffer.

Despite the fact that AACS is strictly on an operational basis, the question of training is still an important one. For the organization is so highly technical that its mission demands the presence of qualified personnel trained in 103 different military occupational specialties. This diversity of interests and types of work has provided a distinct appeal to career officers and men, as much of this training is actually done on the job and can be gained in no other way.

During this interim period, numerous projects were undertaken in implementing the AACS mission of providing a long-line communications-and-navigational-aids system for operation of the Air Force on a global basis. In many cases, communications and navigational aids for these "special" AAF projects involved no additional equipment or personnel, or even the movement of them, as management and coordination, two vital elements supplied automatically with a system such as is operated by AACS, were sufficient to support these operations satisfactorily. Other projects required additional personnel and equipment or a physical rearrangement of available resources. These requirements were met with a minimum expenditure of funds, equipment and personnel because the AACS "system" was available, and only the arrangements for linking the new facilities to the already established networks were required.

After the end of the war, considerable

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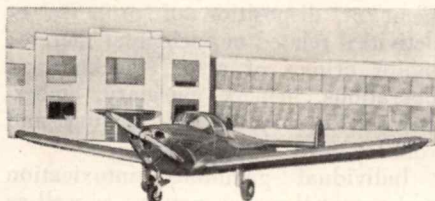
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stress was placed on the use of radar, both ground and airborne, in air-traffic control and navigational aid programs. AACS continues to be very active in this field, particularly with respect to the employment of Ground Controlled Approach, both overseas and domestically. The demand for GCA by the major air-force commanders resulted in the installation of AACS-operated GCA stations at most of the large AF bases in the United States.

An active training program for providing these trained specialists for both domestic and foreign installations was in progress by mid-year, 1947. Arrangements were made for the hiring of twenty (20) GCA experts from the manufacturers of GCA equipment to assist in the training of personnel and in the actual operation and maintenance of equipment in the United States. Thirty-one (31) GCA stations foreign and domestic, were in operation at the end of June, 1947, sixty-eight (68) at the turn of the year, and eighty (80) at the present time.

8. *The future* — I should like to turn, finally, to the role of AACS in the future. We think we are barely on the threshold of electronic applications to problems involving aids-to-navigation and flight control. Out of recent scientific advances, there have arisen difficult questions concerning some of the automatic systems that have grown out of radar. These new methods demand a Systems Concept treatment to an even greater extent than we employ today. This points to a strengthening of the present Air Force policy to preserve the AACS as an integrated system.

I have presented the AACS organization as a working example of the Systems Concept. This concept is not peculiar to AACS alone and it has application to other parts of the AF. The value of communications systems was only one of the lessons about the Systems Concept that we learned in the last war. The extension of the concept to other military operations may well be in the immediate offing.

CIVILIAN COMPONENTS

(Continued from page 60)

more military than the aviation associations, the war-born Civil Air Patrol is beginning to come into its own. Two years ago, Congress made it permanent by the rare act of granting a Federal charter such as is held by the Red Cross and Boy Scouts.

This year, without voiding the charter, Congress made CAP an auxiliary of the Air Force. Limited Air Force aid was hitherto extended under the old war-powers act. The new law will make it possible to go further in supply of training equipment and supervision.

Under a National Headquarters commanded by Maj. Gen. Lucas V. Beau at Bolling Field, there is an Air Force Liaison Officer, a sergeant, and a civilian secretary with office and facilities in each of the 51 Wings of CAP, in the 48 States, Alaska, District of Columbia and Hawaii. Air Force planes, such as C-45's and AT-6's, hundreds of liaison planes and large quantities of radio and other equipment are assigned.

Hence, Civil Air Patrol, as in the last war, is ready to utilize the nation's light-

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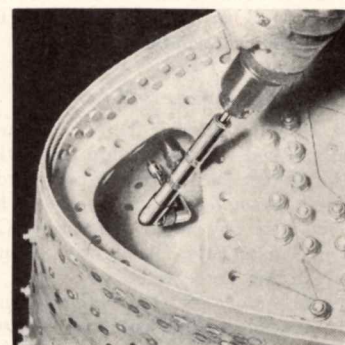
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plane fleet for all manner of military and home-front duties such as coastal patrol, scouting, courier service, and disaster relief. CAP goes into action in peacetime emergencies such as the recent flood in the Northwest where a single CAP squadron flew more than 2000 passengers and brought vital first aid and supplies.

The whole organization, numbering more than 100,000 senior and cadet members with units in hundreds of communities, is on an unpaid volunteer basis. Hundreds of radio stations, operating on special CAP frequencies, insure an independent nationwide communications network for emergency. Missing-aircraft search is another big job, recognized and fueled by the Air Force. Lightplanes, flown by CAP pilots who know the terrain and are intensively trained in precision-search methods, find what they are looking for.

The biggest peacetime job is the CAP cadet program for young men and women of 15 to 18. The similar Canadian corps is filling a large part of the recruiting need of the Royal Canadian Air Force, and CAP is now recognized for similar functions here. A good-will exchange of CAP and Canadian cadets, selected by national competition, was held this summer between the two countries. Next year, there may be a 3-way deal to include England.

Some 5000 CAP cadets are going to summer camp this year at Air Force stations. While CAP does not give flight training, to avoid competition with airport operators, the cadets are schooled in aviation and military ground courses by veteran instructors and are given orientation flights. In many areas, scholarship funds have been raised to pay for their flight training. Extensive airplane model-building activities also are conducted by CAP in cooperation with the NAA Academy of Model Aeronautics, Veterans of Foreign Wars, and other organizations.

CAP is now conducting a large-scale fund-raising campaign, underwritten by the Arizona Wing, to help implement its volunteer work on an even larger scale. In general, CAP is stronger than at any time since the war, but it, too, has suffered from Pentagon vagueness and delays.

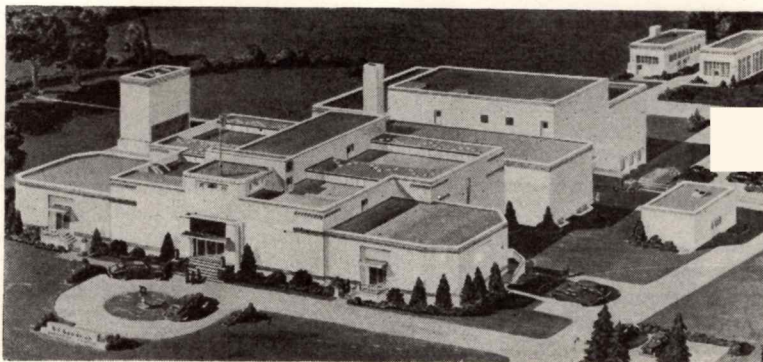
Air Associations

Also close to the Air Force are several special and general membership associations. The Air Reserve Association, composed of Air Force Reserve Officers, has more local chapters than any other, excepting CAP. Air Force Association is open to membership of all Air Force veterans.

National Aeronautic Association is recognized as the oldest all-purpose aviation group, open to membership of all air enthusiasts. National Air Council has engaged in fund raising for general educational purposes in the furtherance of aviation.

Most of the groups enjoyed a post-war spurt, but since have been faced with the problem of membership renewals. Because there are also a great number of other aviation groups, both national and local, it is hard to support so many. Reorganization or mergers are likely before the year is out.

AFA and ARA, for example, have been trying to get together, but any deal is sub-



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ject to approval at their annual meetings and nothing yet has jelled. Meanwhile, NAA proposes joint action between the groups by establishment of national, State and local councils.

Maintenance of at least a few strong associations and of some form of working coalition is not the least of aviation's organizational problems today. It is only by getting these eager civilians together that the public and Congress can be kept aware of the needs of air power in all its phases—

military, commercial and civilian—and progress, all too slow, can be put on a better timetable.

The civilian components of the Air Force today number close to a million persons in all walks of life and in all parts of the country. For grass-roots support in peace as well as for ever-ready preparedness for war, this is a resource that any other nation well might envy . . . and probably would utilize better than we are doing at the present writing.

INSPECTOR GENERAL OF THE USAF

(Continued from page 40)

physical safeguarding of classified information, documents and materiel at Air Force installations and contractor facilities; clearance and control of visitors to Air Force installations and facilities; establishment and use of identification systems and investigation of violations of security regulations which are patently ones of negligence.

He will maintain close cooperation with the various military, Federal, State and local law-enforcement agencies.

The third member of the family came into being as the result of the necessity for an organization capable of carrying out the investigative function divested from the former Air Inspector and to assume new investigative responsibilities bearing upon subversive activities, atomic energy matters, etc. The newly created office of Special Investigations will function in this field.

Objectiveness and intelligence will be required throughout every echelon of the Air Force in order that the investigative function of the Inspector General may contribute to the over-all effectiveness of the Air Force as a member of the National Security team.

The Director of Special Investigations is concerned primarily with the investigative handling of all major crimes occurring within or affecting the United States Air Force, including:

fraud and conspiracy violations, particularly those arising out of procurement or disposition of property or activities related or incidental thereto; major crimes of arson, black-market operations, bribery, burglary, embezzlement, forgery, larceny, perjury, and robbery.

Individual gambling, intoxication and personal moral matters, as well as petty larceny, physical assault and misdemeanor cases will be handled by the Provost Marshal and by commanders under the provisions of pertinent regulations, unless extensive or complex investigation is required, in which event the commanders will call upon the Office of Special Investigations for investigative assistance.

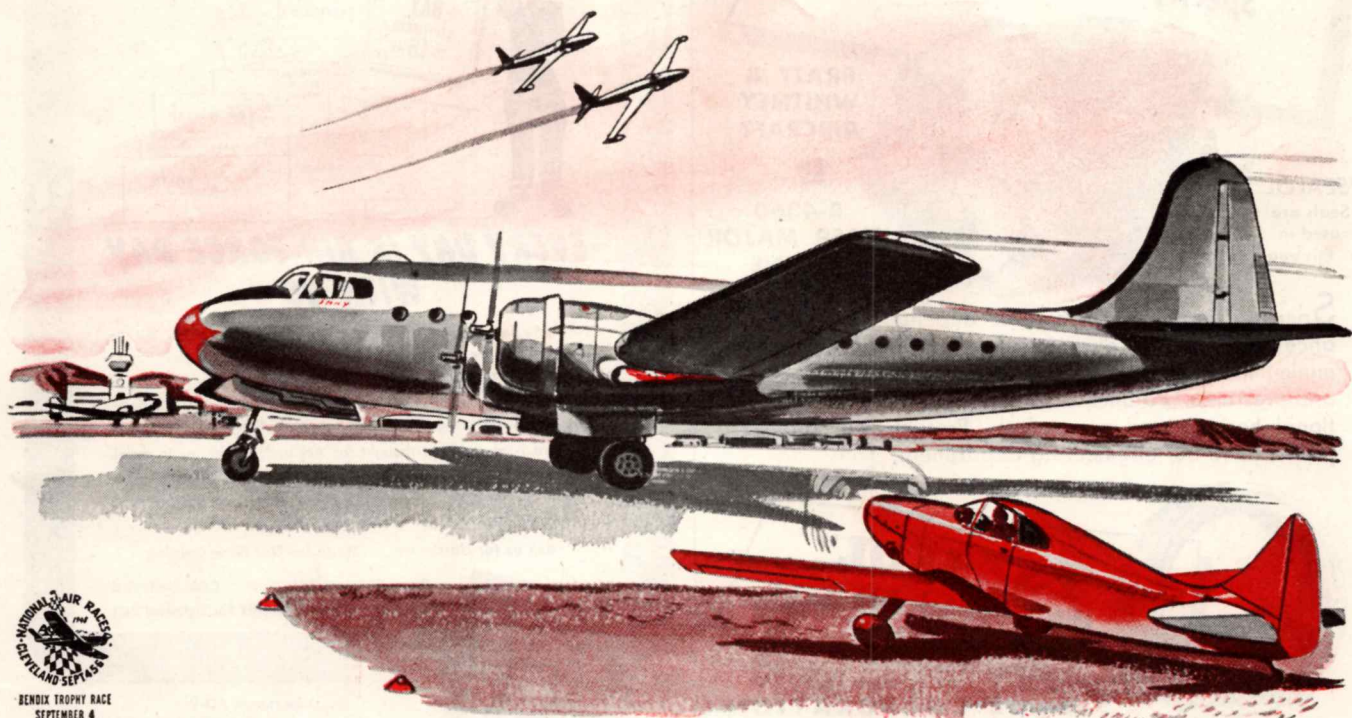
To discharge his responsibilities to commanders in the field, the Director of Special Investigations will place trained personnel in the field, available on call to serve them in all matters requiring trained investigators.

With these three members of the family reporting to him, the Inspector General can exercise tight policy and administrative control to carry out the policies and meet the objectives of the Chief of Staff, United States Air Force, without creating a ponderous centralized office of his own. The three members of the family (Directors) do the operating. As a matter of fact, the

(Continued on page 156)

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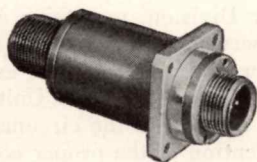


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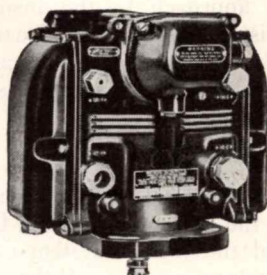
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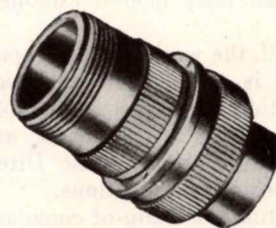
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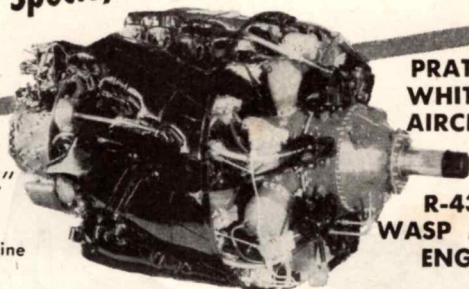


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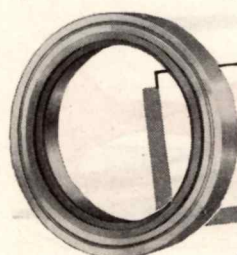
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Office of the Inspector General consists of himself, two other officers and two civilians.

To carry the administrative and operational load of this worldwide organization a total of 2000 officers, airmen and civilian employees are required, of which but 10% are on duty in Washington in the central offices of the three Directors. Compared with like functions in other Departments, this is an extremely modest establishment.

In the field, the work of The Inspector General is accomplished through an organization based upon four (4) Regions, twenty (20) Districts and three (3) Sub-Districts of the Directorate of Special Investigations.

In supporting the chain of command it is a prime objective of the Inspector General to prevent division or dilution of a commander's responsibility and authority. By the same token, the Inspector General insists that commanders unhesitatingly assume responsibility and exercise authority on their own initiative within their jurisdiction. There is no time in Air Force operations to be referring headaches to superior authority. The kind of commanders the Air Force wants to develop are those who cure their own headaches where practicable, within

their own resources and with their own medicine men.

The basic reason for the existence of an Inspector General function is to assist commanders in the production of the most efficient Air Force possible. Every member of the organization understands that such is his mission and that he is not afield for punitive purposes. Commanders, in turn, realize that this approach to the inspection function is for the purpose of assisting them in keeping their house clean and in order, not for the purpose of spying upon them.

Command Authority

As a step in establishing this understanding, the Inspector General, USAF, eliminated the former system of having inspectors general of the major commands report to him. They now report to the Commanders. The Inspector General, USAF, inspects the commanders' inspection system in the same fashion that he inspects other elements of the United States Air Force structure.

As an example of the many activities confronting the Inspector General, we may cite the vastly expanded procurement program of the Air Force. The responsibility for preparing and executing the contracts involved is one

that stems from the Office of the Under Secretary of the Air Force, Mr. Barrows, down through the Office of Deputy Chief of Staff, Materiel, to the Air Materiel Command and its procurement districts. This process involves the expenditure of millions of dollars, the use of vast quantities of scarce materials and the employment of many thousands of people.

All phases of the Inspector General function are involved in maintaining the integrity of procurement. The Air Inspector, through his Procurement Inspector Division, maintains an inspection service designed to determine whether contracts are being executed in the best interests of the United States and if not to call the circumstances to the attention of the proper commander for correction. This is accomplished largely through the Inspector General of the commander concerned in order that he, himself, may take the initiative on corrective measures instead of having an outside agency do it for him. If for any reason the commander fails to take action, the Inspector General will move in positive fashion. It is in this manner that we render a service to, but not under the command of, our major commanders, thereby eliminating the possible charge that military commanders can whitewash themselves

The Provost Marshal, too, has a function in this contract activity. He is charged with the responsibility for security, both in the handling of the contract and in the operation of the manufacturing facility. If he finds laxity to exist in these matters, he calls the attention of the Command Provost Marshal to the facts and, in his role as an extension of the eyes and ears of the Chief of Staff, follows up to be certain that proper corrective command action has been taken.

And so, throughout the gamut of Air Force activities, the Inspector General must function primarily as an advisor and secondarily as a detective and policeman in order that those who are intent upon the welfare of the United States may not be diverted or annoyed by the irreducible minimum of bad actors.

SHRINKING THE WORLD

(Continued from page 32)

Ever since the activation of the Strategic Air Command on March 21, 1946, this business of shrinking the world has been the impetus behind our day-to-day training as well as the force back of seeking new techniques like those mentioned above.

Under the direction of our Commanding General, General George C. Kenney, SAC's goal, besides developing equipment, tactics and leaders, is to give its groups training in logistics, supply, maintenance, flying techniques and other problems peculiar to the long-range missions it must be prepared to execute. In addition, it is striving to familiarize its combat personnel with the varying climatic conditions of the world, and the peoples of the world. Its combat crews must be as familiar with Alaskan conditions as they are with those in the Caribbean. Flying across the Atlantic and Pacific must become as commonplace as crossing the United States.

To accomplish its goal, SAC units are continually flying routine, long-range training missions by day and by night under all kinds of weather conditions. Many of these flights are in the United States but the command has a training program in effect where squadrons or groups move to perimeter bases and conduct tactical maneuvers several months each year. At the present time they are in Alaska, Japan, Europe, the Caribbean area and other regions of the world.

Perhaps the effort that is being poured into this training by the personnel of SAC can be pictured more vividly when it is realized that in one month our combat crews flew, in

(Continued on page 160)

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Octave Chanute

Gentlemen:

Recently I came across a copy of the February AERO DIGEST and noted a letter from O. A. Chanute, stating that he is trying to obtain information about his great-grandfather, Octave Chanute. Here is some that might be of great interest to him:

About seven years ago a man by the name of William Avery died at the age of 70 or so. "Capt. Bill," as he was known, had worked with Chanute, had helped in the construction of many of Chanute's gliders and was the man who tested the gliders.

Some time near the end of this aeronautical venture, Chanute gave Capt. Bill many photographs, pieces of the gliders, slides, newspaper clippings and various other mementos with the comment that some day they might be worth something. As I recall, there were nearly 80 slides in the collection, mostly of Chanute's gliders in flight with Capt. Bill hanging from the lower wing. At various times, Capt. Bill tried to sell these mementos but never was successful.

I came to know Capt. Bill well after I joined the Sea Scout Ship he had organized in Chicago, and several other young men and myself tried to interest someone in the purchase or preservation of the mementos;

but we have never been successful. Several museums have shown interest but usually wanted a grant of money with which to preserve the exhibit.

Capt. Bill's wife, Mrs. Edith Avery, is still living and I believe knew Chanute well. She has possession of the Chanute mementos.

My interest in this business is strictly limited to repaying a debt of gratitude to Capt. Bill for the fine inspiration that he provided for many young men for many years. I do hope that someone will arrange to preserve these documents and place William Avery in the historical niche which he so richly deserves, and to give Chanute the credit that is due him for his pioneering aviation work in this country.

HENRY N. STAATS

Des Plaines, Ill.

We are glad to pass this information along to Mr. Chanute and trust that it may result in preserving these mementos of early aviation history.

Idlewild

Gentlemen:

I wonder why, after the recent air show at Idlewild, someone hasn't written an article entitled "Commercial Aviation Slips Up."

Almost a million people passed through the gates at Idlewild, and I'm sure they all thrilled to the speed of the jets and tremendous size of the bombers. No doubt they all left feeling that our country was being well defended.

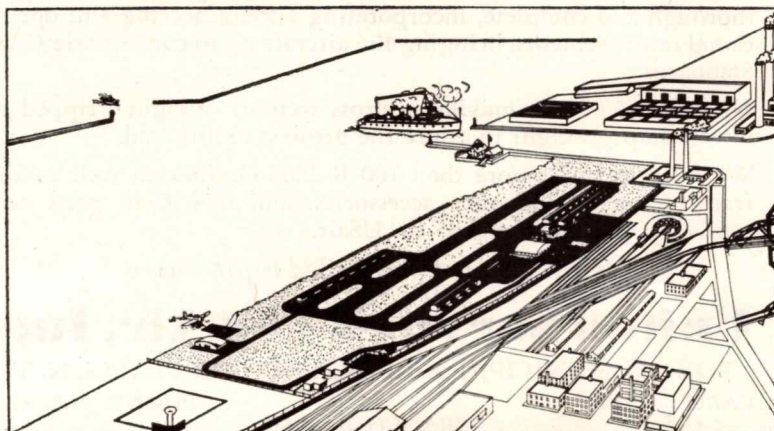
But what of the commercial airlines? To what advantage did they put this golden opportunity? Here we had hundreds of thousands of reluctant customers who had come to view the wares they seemingly want no part of. But I wonder how many of them even gave a thought to commercial aviation.

Except for some DC-6s and Constellations taking off and landing in the distance, there was absolutely nothing (except words) at

Idlewild to let the public know that Idlewild was built to serve them in their travels. Not a single commercial transport was on display. Not a single stimulant of any kind was offered to make the public aware of the convenience and luxury of flying. Idlewild could have just as well been a military air base. No one would have noticed the difference.

Surely the loss incurred by a few idle planes would have been more than repaid by the fact that so many people would have been favorably impressed as far as flying as a means of travel is concerned. It certainly wouldn't have been a cure-all, but it would have been a positive step in a positive direction.

Perhaps there is a very simple reason as to why commercial aviation ignored this opportunity. If there is, I can't find it. I



Proposed development of Maitland Air Strip on the Milwaukee lakefront, one-half mile from the business district. Site includes a going seaplane base, brings together air, water, rail and highway transportation

LETTERS

doubt that the show was intended to be strictly military in nature.

For those of us who are and intend to earn our "3 squares" via commercial aviation, I have a bit of advice to offer the airline operators which was offered to me many times while in the service:

"Let's get on the ball."

MICHAEL SVETINA

New York City

One reason for the lack of participation by the airlines in the Idlewild air show might be the argument over the terms under which the airlines would use the New York International Airport.

Producibility

Gentlemen:

Since I am and have been connected with the manufacturing side of the aircraft trade for 15 years, the "Producibility" article by Messrs. Jones and Harrison (Aug. AERO DIGEST) appealed to me immensely. It said some of the things which I have been trying to get across to engineering departments in this country and in England for quite a while.

During the war, I was concerned in maintenance of large aircraft in Europe, Africa and the U. S. as engineering officer with a foreign airline, and it strikes me there is another angle to the producibility of an airplane. Let us call it "maintainability." Is it more useful to have scads of planes produced which are bad to maintain, and in consequence decorate the hangars or dispersals for overly long periods each time they come in, or to have a few less planes which, if any of the normal troubles happen, can be serviced and airborne in real quick time?

Now if we could combine producibility with maintainability, we would really have something. The only difficulty is, the primary function of any airplane is to fly, either to carry freight or people or to act as a long-range gun. An undue concentration on producibility, with certain fairings and cowlings simplified, will in turn render the airplane less efficient for its primary purpose. The same applies to maintainability, though to a lesser degree. I can visualize cases in which a prime concern with ease of production would impair speed or flight efficiency.

There is also another point. Producibility and maintainability don't always go hand in hand. Very often, to make for ease of production, excellent things have been done, but right at the end, accessibility has been sacrificed by the unavoidable riveting on of the next assembly, thus stopping access to mechanical parts requiring occasional maintenance located in the first assembly.

I hope you will see the necessity for articles on maintainability, in conjunction with those on producibility. The only people who seem likely to raise any objections would appear to be the unfortunate design engineers who must try and please everybody and still make an airplane which will do what it is supposed to do. One can't have everything, but one can at least try.

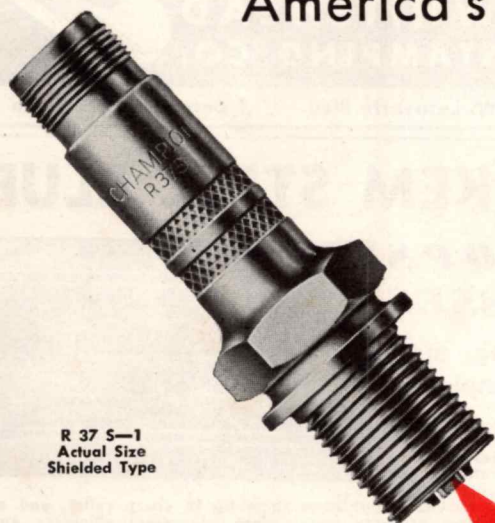
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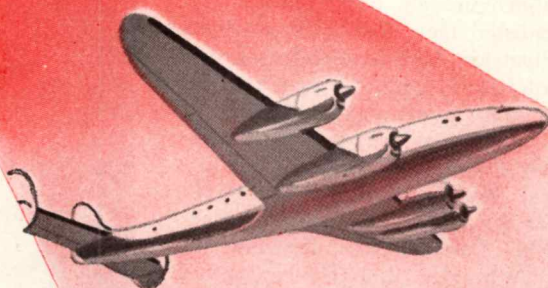
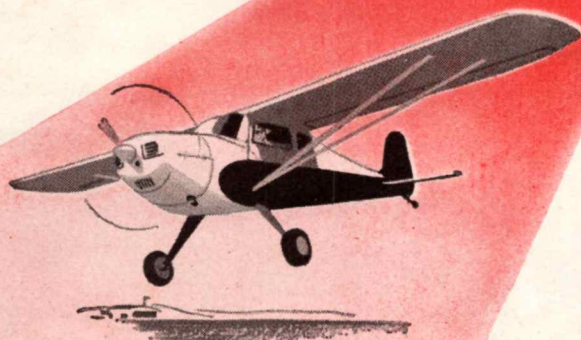


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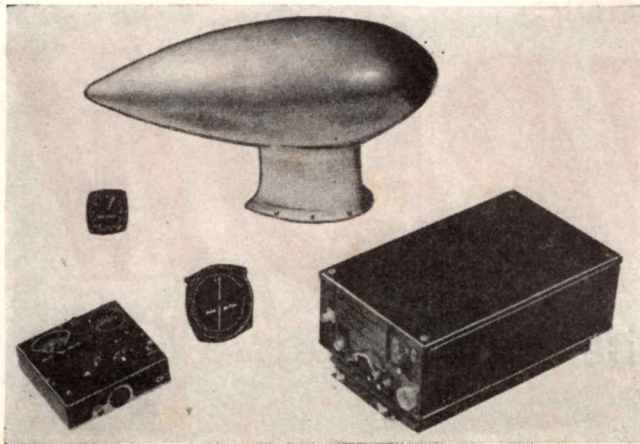
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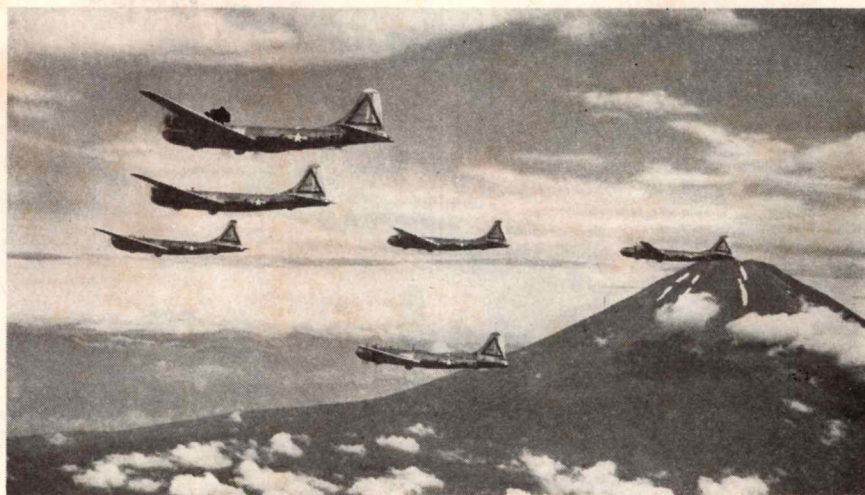
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(Continued from page 157)
all kinds of weather, a total of more than 3,500,000 miles, or around the world approximately 145 times.

The personnel who are accomplishing this shrinking of the world number approximately 5500 officers, 44,000 enlisted men, and 5300 civilians. The Strategic Air Command itself consists of two major air forces and several smaller commands operating directly under SAC headquarters. The 8th Air Force, commanded by Major General Roger M. Ramey controls: Walker AF Base, New Mexico; Carswell AF Base, Texas; Kearney AF Base, Nebraska, and Davis-Monthan AF Base, Arizona. The 15th Air Force commanded by Major General Leon W. Johnson, is higher headquarters for: Smoky Hill AF Base, Kansas; Rapid City AF Base, South Dakota; Spokane AF Base, Washington, and Castle AF Base, California. Andrews, Selfridge and MacDill AF Base—the last-named having Grenier AF Base as a sub-base—operate directly under SAC headquarters. Also within our command is the 311th Air Division, Reconnaissance with headquarters at Topeka AF Base, Kansas, and the 97th Bomb Wing which is jointly occupying Biggs AF Base, Texas, with units of the Tactical Air Command.



SAC Flight "C" near Mt. Fujiama, Japan, just before their all-night run across North Pacific and Aleutians in a record-breaking dash for Washington

The bomber aircraft we are using in these efforts are the B-29 Superfortress, the B-50 and the B-36. The latter two have been received only in small numbers by this command and have not yet been put into wide operation. Our fighters include the F-80, the F-51, the F-82 and F-84.

No article which touches upon the Strategic Air Command would be complete without giving some indication of the mental attitude of this com-

mand. We are a young command and, despite the fact that we include two very famous and war-tried air forces, the 8th and the 15th, our history lies in the future more than in the past. Because of this, "plan for the future" is our byword.

Fortunately, there is no need for this command to educate its personnel to the fact that we *must* plan upon the future. A large number of our officers, civilians and enlisted personnel

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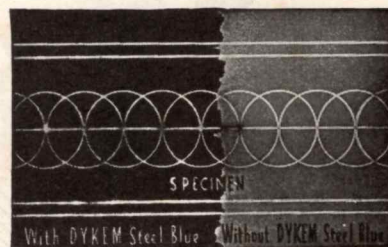
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Charles A. Zweng
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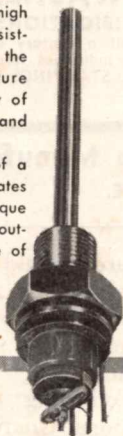
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saw combat action and are cognizant of two facts: one, the victor in any future war will be the nation which first destroys the economic and industrial machine of the other; two, the terrible bombing raids carried out in Japan and Germany, which so disrupted those nations' ability to wage war and their will to win, were not the ultimate achievements of air power. They were merely signposts pointing the way to future greater developments.

It is with this knowledge and this attitude, then, that the Strategic Air Command is busy shrinking the world in order to increase its power of retaliation against any aggressor who might have designs upon this country. A retaliation which, if it is made strong enough, will be the greatest of forces for that world peace which we all so sincerely desire.

AIR DEFENSE TODAY

(Continued from page 48)

the technique of space usage, cargo stowage and similar training.

Thanks to recent favorable Congressional legislation, the United States Air Force Reserve training boasts a new added attraction in that participants are now authorized to receive inactive-duty training pay on an equal basis with the Air National Guard and Naval Reserve.

Another boon to the USAF Reserve program is that more and more corporations are following the example of the Federal Government in granting summer-training period leave with pay to Reservists.

The United States Chamber of Commerce surveyed 1,200 representative companies and found 720 have adopted reserve leave policies. The difference between job earnings and reserve training pay is paid by 270 companies. Regular vacation in addition to reserve leave is granted by 590 companies.

The USAF Reserve program will acquire a "new look" welcomed by Reserve airmen when present arrangements for the reintegration of tactical aircraft into the program are fulfilled. USAF Headquarters has allocated 49 Douglas A-26 bombers and 66 Curtiss C-46 transport-type aircraft for Air Force Reserve training.

Along with their routine schedules, the ADC's USAF Reservists frequently perform mercy flights. Last December, for instance, destitute Navajo Indians, dwelling in northern Arizona and New Mexico, were in dire need of food, clothing and various supplies. The American Legion in Tucson, Arizona, sponsored a drive and col-

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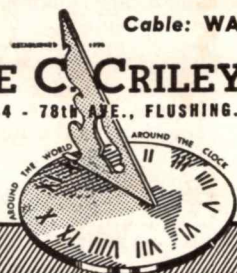
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lected 16 tons of supplies.

Fourth Air Force Reservists piled the supplies into two Douglas C-47's and flew the mercy missions from Davies-Monthan Air Force Base in southern Arizona to Gallup, N. M.

More in the nature of USAF Reserve routine flights was the air feeding of large deer herds, starving in the snow-covered hills north of Wurtsboro, New York, following the severe storms last February.

USAF Reservists from Stewart Air Force Base, Newburgh, N. Y., flying

a Douglas C-47 loaded with two tons of feed, let down to 500-ft altitude over the rugged back-country terrain to insure precision food drops to the starving deer herds.

Recently two Fourteenth Air Force USAF Reservists, both on 15-day active-duty training periods, flew a special-type blood needed for an emergency operation from the Memphis Blood & Plasma Center, to the Veterans Hospital in Jackson, Miss.

In the event of an emergency mobilization, aircraft of the Air National

Guard would comprise nearly two-thirds of the Air Defense Command's total available tactical strength for air defense of the continental United States.

Following the war, the first Air National Guard unit was federally recognized June 30, 1946. Today the ANG boasts 21 groups, 60 Fighter and 10 Light Bombardment squadrons, and has had 390 units federally recognized.

There is at least one federally recognized unit in every State, except Rhode Island. The units include

Fighter wings and groups, Light Bombardment, Air Control and Warning, and Air Service Groups, Weather detachments, Aviation Engineer units and various other specialized organizations.

Present plans call for the activation of more Aircraft Control and Warning squadrons and Aviation Engineer Companies to insure a well-balanced Air National Guard.

Ultimately the Air National Guard anticipates Federal recognition of 514 units, totaling 57,946 officers and men. Of the 84 tactical squadrons included, 72 will be Fighter organizations and 12 Light Bombardment units.

Air National Guard members are being offered a modern training program. In line with the USAF's policy of furnishing the ANG with the most modern aircraft available, deliveries of 107 Lockheed F-80C *Shooting Stars* have begun.

Exact performance figures on the F-80C have not been announced, but an improved Allison turbojet engine increases the plane's speed to 600 mph as compared with the Lockheed F-80B *Shooting Star's* speed of about 550 mph.

Seventy Squadrons

Seventy Air National Guard squadrons throughout the country are now actively participating in weekly flight training. Many units will carry out mock tactical missions this summer during annual field training exercises.

Among the various aircraft being used to train the Air National Guard are the Douglas A-26 *Invader*, Republic F-47 *Thunderbolt*, North American F-51 *Mustang*, North American T-6 *Texan*, Beech T-11 *Kansan*, and Consolidated Vultee L-5 *Sentinel*.

Training in the new Lockheed F-80C jets will start as soon as aircraft are delivered to the squadrons.

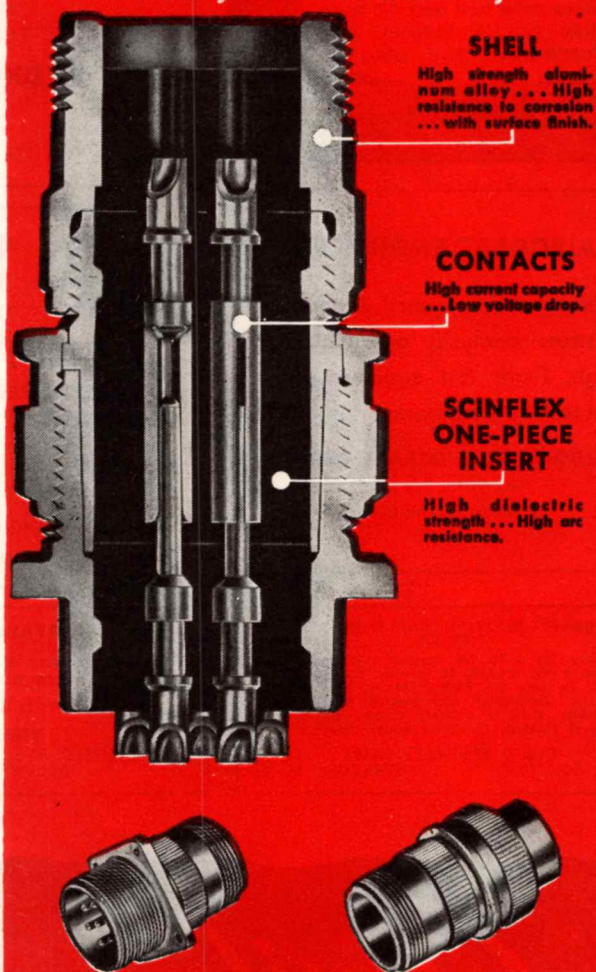
Should war come to this nation again, the country will largely depend on the Air Defense Command to protect its citizens and industries against devastating air attacks.

The Air Defense Command is doing the best it can with what it has to accomplish its missions. Commencement of unit training, acquisition of some tactical aircraft, training pay for the USAF Reservists along with other beneficial Congressional legislation are steps in the right direction.

However, if fulfillment of the ADC's mission to protect the continental United States against air attack is to be reasonably effective, unit training on a far greater scale must be realized, along with the acquirement of far greater numbers of tactical aircraft and combat units.

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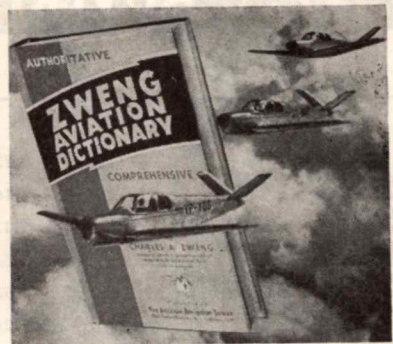
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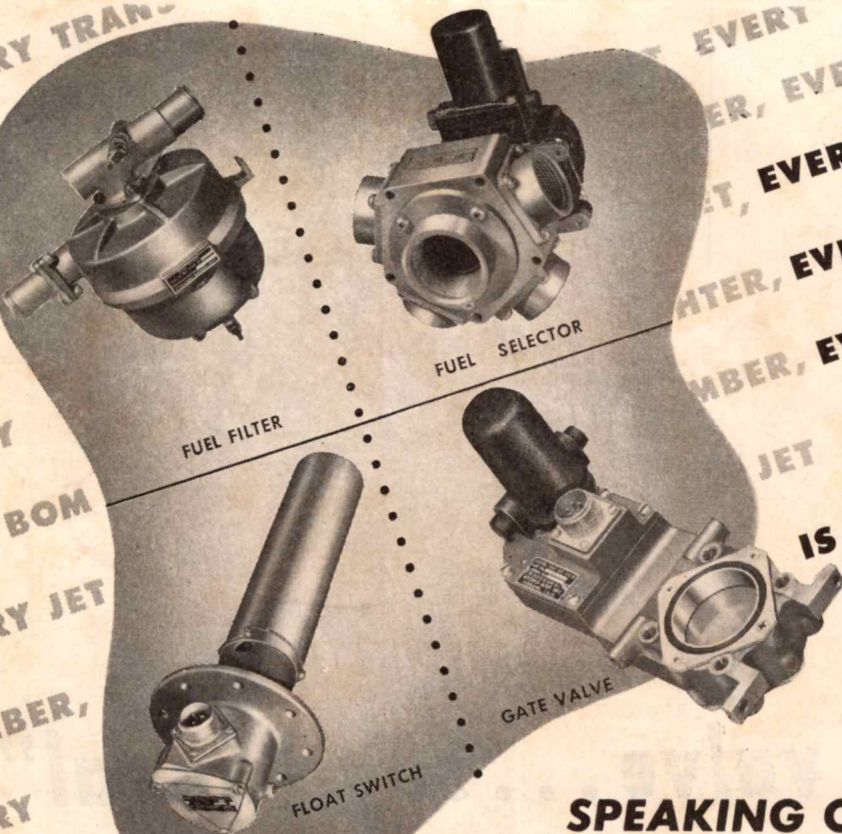
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